BRASS WORLD

AND PLATING — POLISHING — FINISHING

A Monthly Publication Relating to the Arts of Refining, Alloying, Casting, Rolling, Plating, Polishing and Finishing of the Non-Ferrous Metals and Their Alloys

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The Chasing Tools

And How To Make Them—Conclusion*

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Art Metal Worker

WRITTEN ESPECIALLY FOR BRASS WORLD

DUST MATTS

NOW we come to the dust matts. By a matting tool we understand a tool which has the working-end engraved with a certain design, so when you hold and lead it over a surface, softer than the tool, and hammer the other end, you will cover that surface with impressions of the engravings on your tool. To cover the working face of a tool with an even, dust-like appearing roughness, different methods are used. The most common one is to hit the tool with a file of more or less coarseness, or in case of a flat tool, hammering the tool against a flat file lying on the work bench, turning the tool slightly by, then softening the rough file marks by hammering against emery paper. Take a set of your rectangular flats and turn them into dust matts by this method; then file another set into pointed oval flats and dust them in the same way. Break your corners slightly again as you did on the smooth ones. There are other methods of dusting, like hammering against the break of hard steel whereby the grain of the different kinds of steel will produce different shades and the best velvet shades are produced in that way. There is still another way of dusting and that is by etching. But those methods are too troublesome and only used for production of very delicate work.

Next we have the slightly rounded tools. Take another set of 5 of your rectangles and trim the edges into a very light bevel of equal width all around.

Then round the inside edge off towards the center; then emery-cloth, polish and break the outer edges. Repeat that with your last set of 5 and dust them by the file method. For the rounded tools take again two sets of your brandels, file them into rectangles, then by trimming the edges down farther and rounding off towards the center you will get stronger curved surfaces. Polish one and dust another set. You can make some extra sets of oval forming tools, by filing the four brandel corners round. Anyway, there are no regular rules and almost any chaser has his pet forming tools, which he declares are the best ones. But this love is acquired through habit of constant use. I know the most useful ones are the very slightly rounded ones, which are almost flat in the center. Take this from me, never forget to round the outer edges off your marking surfaces if you ever want to lead a chasing tool right.

SPECIAL FORMING TOOLS

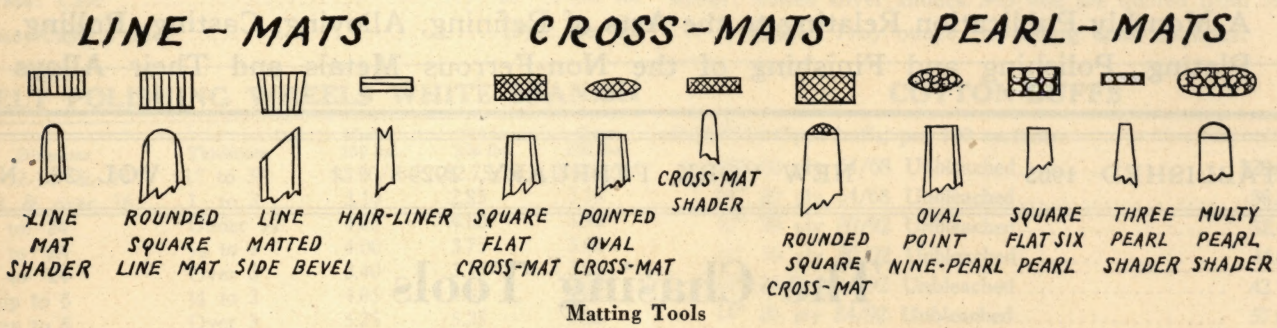
Now we come to a group which I classify as special forming-tools, side bevel tools and hollow tools. Those side bevels are easy to make, because they have the same form as the main forming tools, only slanting and anyone who made the main forming tools can make them easily. (See picture below). Make yourself about six different sizes and you will have enough for almost all purposes.

Now we have the hollow tools. There are first the hollow pearls. With our five kinds of brandels we can make the ten most used sizes easily. File your work-ends into squares the same way you did for the pearl drivers. Don't forget to square the squares to the center line exactly. Center punch slightly, then run a drill into your centers half the depth; then your pearl will be wide.

Then take a round nosed engraving tool of corresponding size and round your hole out. At last you can use your pearl drivers and stamp it into your hollows. Then take your brandel corners off and file the edge around your pearl. Polish with a piece of pointed wood, around which you wind some worn crocus paper. Don't forget to break your pearl-edges slightly. A good set of hollow pearls is one of the prides of a chaser and he will never misuse it as a rivet set or nail driver. There are other hollow pearling tools, like the square ones and the oval ones, but they are very seldom used and can be made to the job on hand by the same method; only there has to be a little more engraving done.

* The first part of this article appeared in the January issue.

The next sort of hollows are the square hollow forming tools. When you make about 6 sizes of those, ranging from 1/16 in. x 3/32 in. to 3/32 in. x 5/16 in. you will have the principal sizes for the common run of work. File your rectangles, square off, then run the half-round side of your file along the centerline of the length of your rectangle until you have a groove of about 1/3 of the circle; break the end corners very well on those tools and the side edges too a little. Then polish by rubbing over a rat-tail file of corresponding size with fine emery cloth around it and crocus paper afterwards.



Matting Tools

Next we have the long hollow tools which I put under this group. They come in very handy and every chaser should have 3 or 4 of them. Take some of your bigger size brandels and file them into long rectangulars, the same way as you do for straight tracers; then hollow your rectangle by filing crosswise. (See picture). Be careful to round the edges and point well, then polish. This will give you the principal forming tools.

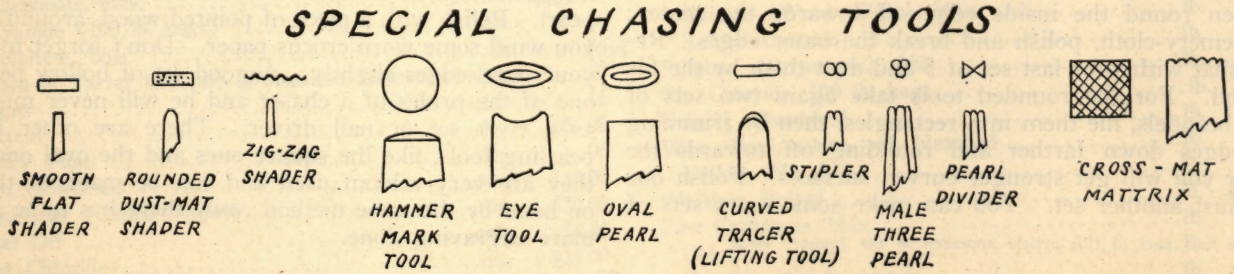
MATTING TOOLS

And now we come to the last main group, the matting tools. Again there are three different kinds, the line matts, the cross matts, and the pearl matts. The line matts can be made easily by rubbing any formed chasing tool over a file back and forth, the different coarseness of files producing lines of different width and depths. You will probably have to straighten some by going over with a graver point. You can make a dozen of different sizes and coarsenesses, and some side beveled ones, having the lines running up and down the bevel. In this group I place the hair-lines. Those tools are nothing but two or more straight sharp edges, placed alongside each other. Take 3 of your smaller brandels, file them to rectangles like for straight tracers, then cut, with a very sharp graver point, a groove in the center along the length of your rectangle; then file from the outside until the tool appears like two very narrow tracers close together. When you have three of different sizes you can do the most matting for which this kind of tool is ever needed.

Now for the cross matts. Those tools are made with matrices and so are the pearl-matts. The making of matrices is more of a jeweler-die-engraver job and takes very good eyesight and skill. By a matrix I understand a steel-block having certain designs engraved on one or more of its surfaces. Sometimes there has to be made one matrix first and stamped into another steel-block in order to get the right matrix. But cross-matt matrices almost every Chaser can make for himself, and having three of different grain in his tool box enables him to make all the cross-matting tools he ever can use in his sweet life and after.

To make them, make first three straight, sharp double tracers of different widths, the same way as you did the hair-liners, only sharper and the groove deeper. Make very sharp edges and outside bevels. Break the end corners slightly, then harden and temper. Then take three pieces of your 3/8 in. steel of about 3 inch length and square one end. On the other end break the corners and edges a little. Then put one in the vise, square end up, and make, with a sharp straight tracer, two diagonal lines across. Then take your double tracer and lead on edge along your diagonal, driving in at the same time, the other edge into the steel. You will have two parallel lines now. Then repeat by following with one edge in the second line and making thereby a third, and so on till you have your square covered with diagonal lines in one direction. Then proceed with your other diagonal the same way. When finished, you will have the surface of your square covered with little half cubes all of the same size and form. Repeat on all three of your steel blocks and you will have three fine cross-matt matrices, of different grain. Harden the working end carefully and give only a very light temper. Now proceed with making your cross-matts by stamping your formed chasing tool into the matrix for flat matts or leading your matrix over rounded tool surfaces. Having those matrices made once, enables a chaser to make all the sizes and forms of cross-matts.

Now we have the last and most difficult to make, the pearl matts. There is a way in which a chaser can get around making those tools without using matrices, namely by using very small pearl drivers and stamping them in the desired design into the working surface of the tool. But that takes great skill and very good eyesight. It takes much more skill and time to make those matrices, because there you have to turn your females into males by restamping one matrix into another, and it will hardly pay a chaser to do that for the couple of dozen he will ever need. The best way is to make the bigger sizes



by hand, and buy the small sizes of some jewelers' supply house ready made.

For the most, chasers are only the female matting tools, (tools which have their grains sunk into the work-surface of the tool) of any importance. The male tools are mostly used by mould makers, brass die makers and steel die sinkers. Matting and shading is not very much used at the present time, but used to be a great art and there are other sorts of matting tools which are hardly ever used any more. I will give the picture of some with names which will explain them and other special tools. Anyone who can make the others will be able to make them too.

Now, at last, a word on hardening and tempering those tools. Put some common soap on your work end then hold your tool with a pair of pliers into the end of a blue flame and be careful so the flame strikes the tool about half of one inch above the working end. Never hold your work-end into the flame because you run chances of burning your edges before your tool gets sufficient heat. Watch till your work end turns a light cherry red, then drop your tool into warm water. When you find your tool shows a whitish gray color where your soap melted during heating you can be almost sure your tool is well hardened. Then take emery cloth and polish your brandel-sides clean on all four sides, but not the working surface. Then hold your tool again in the flame; this time keep it ¾ in. away from the end and watch till that end begins to become light straw yellow. Then drop the tool into cold water. After taking out and drying, polish the working surface of the smooth ones on a piece of crocus paper and the matts with a common rubber eraser. You will have a couple of dozen brandels left for specials. Good luck!

Alloying White Gold

Q.—I have the following formula for 18-karat white gold:

	dwt.	grains
Zinc	1	13½
Copper	0	18
Nickel	4	4½
Fine gold	18	18
Total	25	6

First I place the zinc in the crucible and cover it with boracic acid crystals. Second, the copper; third, the nickel; fourth, the gold. Then all is covered with boracic acid.

But here is my trouble: after melting for six minutes, there is a little of the alloy not yet melted, and if I pour it, this gold will work very well but it is a gold higher than 18-karat and has not a good color. Now, when I take the same quantity of gold and alloy and pour it after seven minutes, all the metal is molten, but the result is a gold that is hard and brittle. Is there something wrong with the formula, or with the flux? I believe my fine gold and alloy are all best quality metal.

A.—The trouble with making white gold lies in the melting, not in the formulas. There are several excellent formulas, but it is hard to get the necessary high temperature and at the same time prevent oxidation, etc. Consider your formula, for instance: it contains zinc, which melts at a very low temperature and is easily boiled away, and also nickel, whose melting point is very high. By the time your heat is high enough to melt the nickel, your zinc is probably volatilized. That is why so many small shops, as well as many large ones, buy their white gold ready-made, or, buy ready-made white alloys, and melt them with their fine gold.

The best crucibles are graphite crucibles made to pour from the bottom. These are called "bottom-pour" crucibles. Boracic acid is the best flux. The metal should be stirred, preferably with a hot carbon rod. Keep it covered when not stirring.

Most people melt up the proper quantity of nickel, copper and zinc first, adding the zinc after the others get hot. Granulate the melt by pouring it into a bucket of water. Collect the granules and weigh; if there is any loss in weight, figure that it is zinc. Then take that mixture, and melt it with your fine gold; after it gets hot, add more zinc if there was any loss before.

Pour into a closed ingot, using an ingot so small that your melt will fill it. While pouring, hold the mold tilted sideways, so that the hot metal will not fall and splash on the bottom, but run down the sides. This wil drive out air.

—Jewelry Metallurgist.

Removing Nickel from Steel

Q.—One of our customers desires information as to how he can best remove old nickel from plated steel surfaces in order to apply a new coating to best advantage. He would prefer to use the reversed electrolytic process but would like to know what solution is best for immersion of the parts.

A.—To remove a nickel deposit from iron or steel is quite a difficult operation without a roughening of the steel when the reversed electrolytic process is used. Either sulphuric or hydrochloric acid diluted with water can be used for the electrolyte. The latter works faster and does not roughen the surface of the steel so rapidly. Use the following solution:

Hydrochloric acid ..... 1 part
Water ..... 3 parts

Room temperature. 6 or 12 volts. Lead cathodes.

The acid content may be increased but the larger the volume of acid the greater the amount of gas evolved and this is objectionable unless eliminated with a proper exhaust system.

—Oliver J. Sizelove.

Action of Mica on Cadmium

Q.—Kindly tell us at once what action mica has on cadmium.

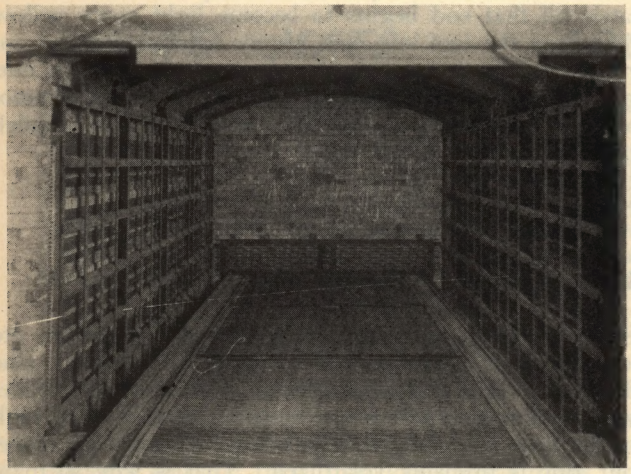
A.—We cannot see where there would be any action of Mica on cadmium. Mica is an oxide of silica and is used as an insulator for the electric current and heat. It is insoluble in water or acids, with the exception of hydrofluoric acid. It is soluble in hot fixed alkalis forming silicates and there may be some action between cadmium and these salts.

—Oliver J. Sizelove.

Furnaces for Heat Treatment of Metals

The illustrations herewith show the marked contrast in sizes of electric heat treating furnaces for metals. These are manufactured by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., who describe the equipment as follows:

Despite the most striking differences in product,



This Electric Furnace Heat Treats Aluminum for Airplane Wings

Westinghouse industrial furnaces have to solve similar problems of quantity production, of minimum investment, and of low operating cost to meet a very competitive market. A striking contrast in types is offered by a dental furnace for enamelling false teeth, and a furnace for heat-treating aluminum for airplane wings.

Heat-Treating Aluminum for Airplanes: The first airplanes were kites of wood and cloth, but metal frame-work developed years ago, and now many planes are metal throughout. Aluminum is the only metal light enough for wings and fuselage covering, and this aluminum alloy must be heat-treated to develop its strength.

Electric furnaces for this heat-treatment built this year are especially notable for exact and uniform control of temperature. The alloy's annealing temperature is very close to its melting point. Not only must the temperature of the furnace be exact, but the temperature gradient between heat source and work must be low. A very large area of heating surface is worked at low wattage per square foot.

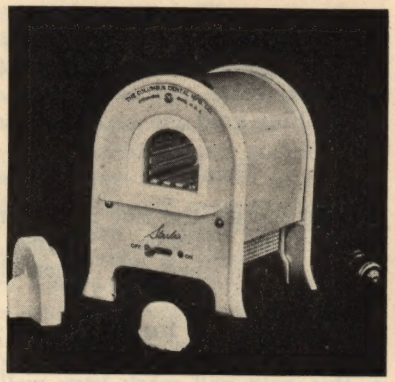
Control is by pyrometers which actuate control contactors through low-energy industrial-heating relays operating on unusually small temperature differentials.

The success of the first two furnaces was followed by an order for three more.

High strength aluminum alloys are increasingly used for other purposes, as well as aircraft. It may be expected that such precision heat-treatment will be in growing demand.

Dental Furnace: The work requires extremely careful and exact treatment, since correct appearance of artificial teeth is essential. The individual tooth made by the dentist to fit the patient's need is baked, glazed and stained.

This furnace has a heating chamber 3 inches deep by 2 inches wide by 1 inch to the place where the curved roof starts to be pronounced. The overall dimensions are 6½ inches wide across the legs by



With This 1960° F. Dental Furnace, the Dentist Can Produce Beautiful False Teeth

7 inches long by 7½ inches high. It is rated 500 watts, 110 volts, and reaches a temperature of 1960° F.

Only one tooth is baked at a time. It is placed under a porcelain hood to protect it from foreign particles and reaches full temperature in 26 minutes. The temperature attained is indicated by the melting of a gold pellet on top of the porcelain hood. This tiny furnace, operating on 110 volts, is intended for use by the individual dentist, and is being produced at the rate of 500 a month.

Spots on Brass

Q.—We are troubled with spots breaking out on our plated brass finishes, especially the polished brass. This breaking out, we assume, is cyanide spots. We ask that you kindly advise us the period of time necessary in boiling and baking to counteract this tendency. Also, the temperature in baking oven best suited for the purpose described. Moreover, please recommend a neutralizing bath. We are now trying immersion cream of tartar.

A.—For the elimination of cyanide spots that usually result in copper, bronze or brass plated cast iron surfaces after finishing and even lacquering, cream of tartar is an excellent material when used in boiling water. From ⅛ oz. upwards per gallon of water at temperature of 200° F. is required.

The articles should first be washed thoroughly in cold and boiling waters and vice versa, then immersed in the cream of tartar solution just so long as there is no perceptible reducing action on the plated metal—15 minutes minimum. Rinse in boiling hot water and dry at a temperature in excess of 212° F., the temperature of boiling water, to evaporate any moisture in the pores of the metal.

An alternative method would be to first immerse in a heated solution of 200° F., consisting of dehydrated lime 1 oz. per gallon, then wash thoroughly in boiling water; immerse in an acid dip consisting of ⅛ oz. or more of tartaric acid, phosphoric acid or cream of tartar. The acid factor in the latter is tartaric acid, so ⅛ oz. of this acid would more than equal the acidity of 1 oz. of cream of tartar.

—Charles H. Proctor.

Air Conditioning Aids Production in Battery Plants

The introduction of mass production systems in the manufacture of electric batteries, says The Modern Science Institute, Inc., Toledo, Ohio, has been made possible through the efforts of air conditioning engineers, who have applied to this industry some of the most modern developments in factory operation. The demand for electric batteries is today without precedent, both for volume and variety, and quantity production was urgent if the output of batteries was to keep pace with demand. Now some of the larger battery plants are operating on production lines similar to those that have been introduced into the automobile plants and other heavy-production industries. Thousands of batteries move forward daily on belt conveyors while men stand like a gauntlet down the line to affix parts and perform operations which finish the product that gives electrical energy for starting and lighting millions of automobiles.

Scientific application of the latest engineering developments to cut costs, improve product, speed up output and protect the health and lives of workmen, has been adopted in one big eastern plant. It is in this plant where fumes from melted lead, gases and poisonous dusts used in large quantities are recovered by control of air conditioning through a system of powerful ventilating fans which segregate these hazards without danger to workers.

In the group burning room of this plant, where the battery plates are formed into groups, lead lugs of considerable weight are blown through pipes by an air pressure which approximates three miles a minute. These lugs, which are the ragged edges cut off the plates, are re-melted to become the material in other plates. Fine lead dust and other materials are handled in this way, although the company uses an air washer to recover lead dust from the air which is blown through a spray of water. The air washer recovers approximately 75 pounds of lead per week by removing the dust, according to the plant engineer of the company.

In the foundry, hoods are used over the lead pots to collect the lead oxide fumes which come from the melted lead. Suction fans draw the fumes up through large pipes to remove the danger from workmen. One of the most unusual applications of mechanically controlled air in this plant is for the purpose of blowing acids from the storage rooms near the railroad tracks through pipes a distance of 500 feet into the developing room where the acids are poured into the battery which, acting on the plates, produce electrical current.

In the box room of the plant, where wooden separating plates and other wooden products are made, scrap lumber, sawdust and shavings are blown by air suction to another part of the plant and used as fuel.

In cooperation with air conditioning experts, this company has developed a dustless system of blending lead oxides to manufacture battery paste. In former years this was considered impossible. The work is arranged in such a manner that all the various operations are synchronized into a co-ordinating closed system. The result is that lead oxide is being handled at a rate of 5 to 6 tons per hour.

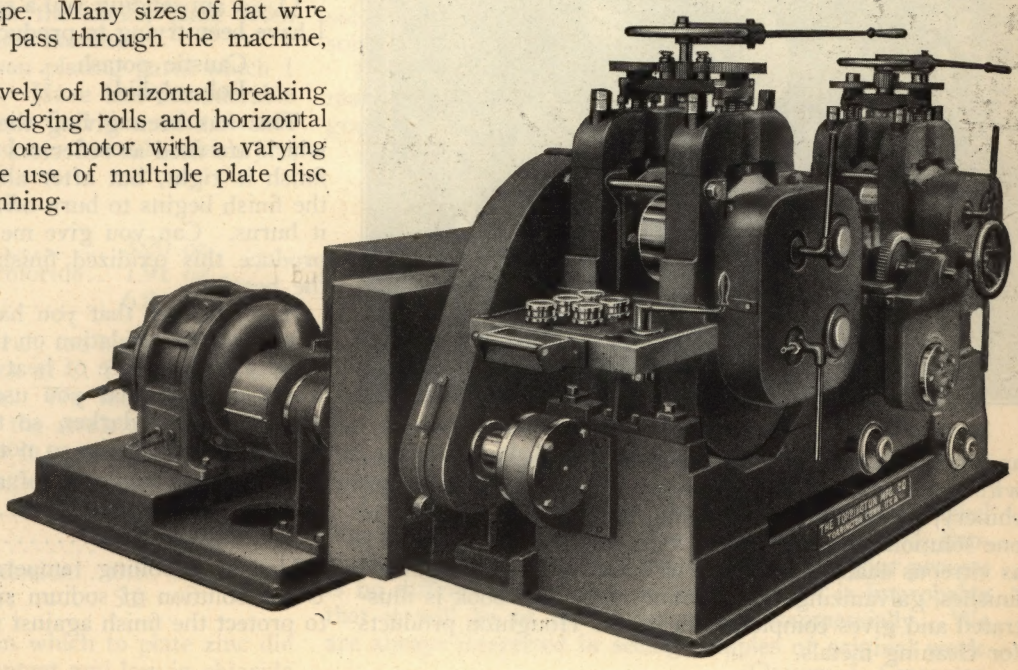
Mill for Rolling Flat Wire

A new type of machine for the manufacture of flat wire with round edges or corners has been designed and placed on the market by the Torrington Manufacturing Company, Torrington, Conn. The following details of its construction and operation are given by the manufacturers:

A new design of tandem rolling mill for the high speed production of flat wire, with round edges or round corners, such as flat electrical conductors or wire of any other material having a similar shape. Many sizes of flat wire may be finished in a single pass through the machine, from round rod.

The mill consists successively of horizontal breaking down rolls, vertical grooved edging rolls and horizontal finishing rolls, all driven by one motor with a varying speed relation secured by the use of multiple plate disc frictions adjustable while running.

The mill is equipped throughout with "SKF" ball and roller bearings, making possible the attainment of greatly increased rolling speeds. Sykes double helical driving gears are used. Breaking down and finishing rolls are water cooled. Facility is provided for the quick and accurate adjustment of all rolls. Complete guides are included. Suitable winders of several designs are available for use with this mill.



Newly Developed Machine for the Manufacture of Flat Wire of Various Kinds

White Bronze Mixture

Q.—Please let us have directions for mixing a good white bronze. We would like to have the ingredients separately listed and also the most convenient forms in which to handle them.

A.—A good white bronze can be produced from the following ingredients:

Copper	54
Zinc	16
Nickel	17½
Tin	2
Lead	10
Aluminum	½

In order to get this in a mixture, you can make it up as follows:

Shot, 50 Nickel—50 Copper	35
Copper	36½
Zinc	16
Lead	10
Tin	2
Aluminum	½

—W. J. Reardon.

Cleaning Compounds and Methods

A large variety of cleaning compounds for metals and other products are manufactured by E. F. Houghton and Company, Philadelphia, Pa., which has just issued an interesting 34-page booklet on the subject. The book treats also of methods of cleaning metal products in various kinds of plants such as automobile factories, oil, enameling, plating and finishing works, railroad yards, wire and rolling mills, etc. General plant cleaning operations are dealt with also. The book is divided into chapters, beginning with a general introduction on the subject of metal cleaning, giving general directions. Tanks

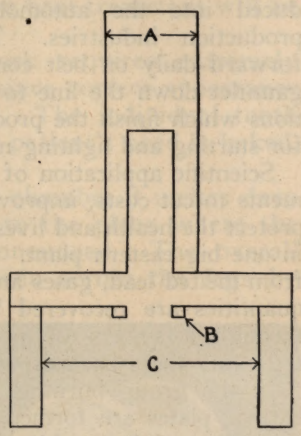
and tank systems are described and discussed, together with such matters as agitation, pumping, washing machinery, steam used in cleaning, plating and cleaning in one solution; cleaning before various other processes such as vitreous enameling, all the well known electro-deposited finishes, galvanizing, rustproofing, etc. The book is illustrated and gives complete data on the Houghton products for cleaning metals.

Reaming Cocks or Faucets

Q.—We are making special ground key cocks in lots of 25 to 100. At present, we ream the tapers in the barrels by roughing out with a flat tapered reamer and then we finish with a square tapered reamer. The tools are rotated at slow speed, while the work is fed up floating. We are looking for a more rapid means of handling this work and wonder if you can suggest anything.

A.—Generally speaking, your present method is correct in handling small quantities of these cocks. Use a fluted tapered finishing reamer for finishing cut; see that the roughing and finishing reamers have the same tapers and that there is no rough scale for the finishing reamer to cut. The rough surface must be removed with a roughing reamer; a fluted reamer would lose its cutting edge on such a surface.

In the sketch you will see a holder for placing the bodies of the key cocks in a turret hole to hold them when the rough and finish reaming are done. Make diameter at A about 1½ in., or cut it to fit hole in turret. Let bottom of cock rest on point B. Body or barrel fits in space C, which should be filed accurately for it.



Sketch of Holder for Reaming Cocks or Faucets

We would suggest that if you have a drill press, you can ream these bodies on it by the use of a holding gig or device. The reamers should revolve in the spindle of the drill press.

The square reamer you are using is impractical for finishing as the barrels will not be round unless you revolve at slow speed. By using a fluted reamer you can rotate at higher speed and the flutes can be ground in a small universal grinder to maintain the correct taper.

—P. W. Blair.

Oxidized Brass for High Temperature

Q.—I am sending you a sample of oxidized brass which I have been trying to produce effectively in the following:

Caustic potash	2 ozs.
Polysulphide	1½ ozs.

This has been giving the proper color for the plates, which are used as reflectors for heat in gas heaters. The finish is right, but after about an hour's use in a stove the finish begins to burn off. First it just fades out, then it burns. Can you give me a formula with which I can produce this oxidized finish and have it hold up under the heat?

A.—I believe that you have quite a problem in trying to produce an oxidation on the brass plates that will withstand a high degree of heat without changing color. We would suggest that you use the following solution and make the color darker, so that when the color starts to change it will not be so noticeable:

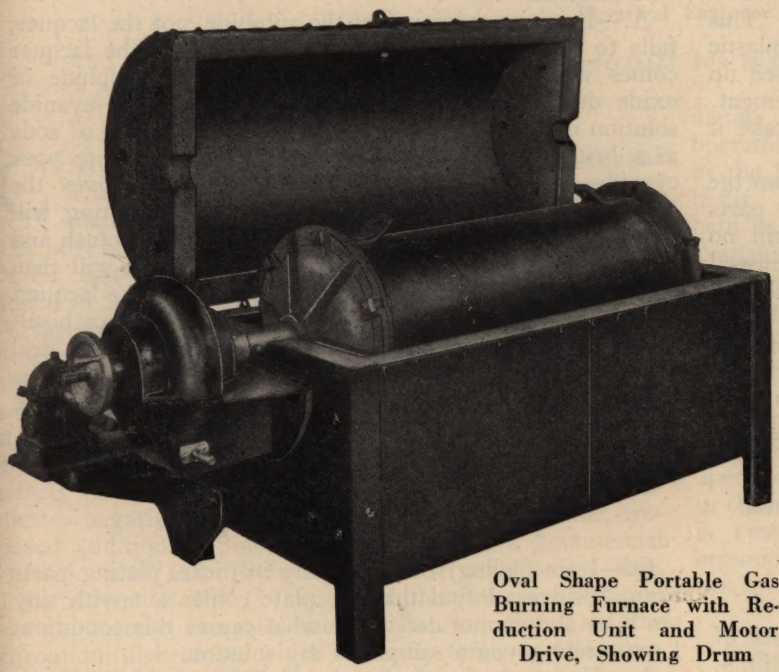
Goden sulphuret of antimony	2 ozs.
Caustic soda	8 ozs.
Water	1 gal.

Use near boiling temperature and scratch-brush dry. Use a solution of sodium silicate registering 20° Baumé to protect the finish against the heat of the gas.

—Oliver J. Sizelove.

Sherardizing Apparatus

The New Haven Sherardizing Company, Hartford, Conn., has rounded out eighteen years of experience in its field of producing equipment for sherardizing, heat treating, plating and various other metal finishing operations. The company has also during this time developed extensive jobbing units for performing in mass production the work of metal finishing for other manufacturers. The company has a plant and general offices at Hartford, and a branch plant at Akron, Ohio. Branch offices are maintained at Detroit and Los Angeles, while foreign business is handled by the company's representatives in New York, Oliver Brothers, Inc.



Oval Shape Portable Gas Burning Furnace with Reduction Unit and Motor Drive, Showing Drum

Naturally, the company's chief products are those used in producing the finish known as sherardizing, which consists of the application of a coating of zinc to another metal, usually iron or steel, which needs to be given a rustproof surface. This process is performed by the use of a furnace containing a drum, a typical example of such an apparatus being shown in the accompanying illustration. In this furnace, known as the No. 10 Oval Shape Portable Gas Burning Furnace, there is a tank in which the work to be coated is placed, together with a predetermined amount of zinc dust. The work and zinc dust are enclosed in the drum, the furnace is closed and the heat applied while the drum is rotated for some hours. A large quantity of work is done at one time. Among the advantages claimed for this method of applying a zinc coating to metal products is the fact that the resultant surface is highly resistant to rust, as well as capable of resisting considerable abrasion, which makes such a surface applicable to products which must undergo wear and friction. Hollows and recesses are penetrated, it is stated, and in every way this finish has been found highly desirable. Among its applications are coating of foundry flasks, tubing (inside and outside), machinery parts and other products.

The New Haven Sherardizing Company makes all equipment necessary for the process, and also distributes the zinc dust used. The company also makes automatic screeners and other apparatus.

Among the finishes produced in the company's job shops are sherardizing, Udylite, chromium, nickel and copper. The company is a representative in its district for the Udylite Corporation of Detroit, Mich.

Defective Nickel Solutions

Q.—I am sending you two samples of nickel solution. The No. 1 solution has been used for general plating, such as brass, white metal, etc. Up to the present time we have been unable to prevent the nickel plate from peeling on white metal bowls and handles.

In No. 2 solution we have been plating parts which I think are of a zinc composition. Have had considerable trouble with this solution. If you find this solution unsatisfactory, will you please send me formula which you think might be advisable to try?

A.—Analysis of No. 1 solution:

Metallic nickel	3.20 oz.
Chloride as ammonium chloride	1.91 oz.
pH	6.8

The pH of this solution is entirely too high. We would recommend the addition of 10 ozs. of C. P. sulphuric acid to each 100 gallons of solution. We might also state that it is good practice to flash the work that has white metal parts soldered to the brass in a warm cyanide copper solution before nickel plating.

Analysis of No. 2 solution:

Metallic nickel	3.14 ozs.
Chloride as ammonium chloride	0.5 oz.
pH	5.2

This is a very poor solution in which to plate zinc die cast work. It is high in acid content and low in chloride content. This should be just the reverse. The solution can probably be made to work satisfactorily by adding 1 pint of ammonium hydroxide for each 100 gallons of solution and 7 ozs. of sodium chloride to each gallon of solution.

If the solution is not too large, we would discard it and make one from the following formula, which will give good results:

Double nickel salts	10 ozs.
Sodium chloride	7 ozs.
Boric acid	2 ozs.
Sodium citrate	1 oz.
Water	1 gal.

—Oliver J. Sizelove.

Dip Nickel Process

Q.—Do you know of any commercial dip nickel finishing process on the market? I have worked out a formula for a solution that will produce a nickel plate on brass, copper or zinc by dipping.

A.—As far as we know, there is no successful nickel dipping process in use. The immersion method generally produces a very thin deposit, so that if your process is no different than those we have seen, it is improbable that it will be of much importance commercially. We are always interested in seeing samples of original work.

—Oliver J. Sizelove.

Cementing Metal to Glass

Q.—As a subscriber to your magazine, we are seeking some kind of a cement which we can use in cementing silver-plated trimmings onto glassware, such as a glass liquor mixer with silver-plated top. We wish something different than plaster of Paris, something that will harden and withstand water and other liquids.

A.—The cement used for securing metal to glass is prepared from pure yellow litharge and glycerine. This material should be prepared so as to produce a plastic mass. Only prepare as much cement as can be used up quickly to prevent waste. In preparing the cement, sprinkle the litharge into the glycerine, so it will take it up and produce a smooth cement.

We give you a second cement formula, taken from the "Metal Workers' Handbook." Intimately mix 100 parts by weight of pulverized white litharge (yellow will no doubt answer); 50 parts dry white; 3 parts boiled linseed oil; and 1 part copal varnish. Mix very thoroughly before applying.

It is possible that a cement prepared from concentrated silicate of soda and powdered glass may answer your purpose. In Henley's "20th Century Receipts and Processes," will be found several cements under "Dental Cements" that may answer your purpose. This book will be found in any reference library.

—Charles H. Proctor.

Making Nickel Anodes

Q.—We have been advised to make nickel anodes of the following composition: Nickel, 92; old files, 4; tin, 4. Will you kindly advise us what is meant by "old files?" Does it mean steel files such as are used by machinists, etc., or is it "filings" that are produced by using a file? Are these added to secure the carbon content of the anodes?

A.—Steel files are made of high carbon steel. When added to the anode composition they provide iron and carbon, both of which are necessary to produce a soluble nickel anode.

We have at hand the following composition, which is said to produce a nickel anode capable of maximum results:

Nickel	95%
Carbon	1.05
Tin	2.05
Iron	0.25

Copper should always be present only as an impurity. There should never be more than 0.025% of it.

—Chares H. Proctor.

Galvanoplastic Work

Q.—I understand that in galvanoplastic work a certain kind of lacquer and metal powder are applied to make the non-conductors conductive. Will you please outline the general scheme followed in this kind of work?

A.—The usual method that is employed in galvanoplastic work is to make the article impervious to the plating solution and is accomplished by waxing or lacquering the work.

It is then metallized by spraying a copper bronze powder mixed with lacquer upon the article. Use a special copper bronze powder that is made especially for this work and a good grade of a cellulose lacquer thinned to proper consistency. Any of the lacquer manufacturers that advertise in The Metal Industry can supply you with the proper lacquer.

—Oliver J. Sizelove.

Flaking Lacquer

Q.—I have had some difficulty with lacquer flaking off after being applied to tin tubing. The tubing is cyanide copper plated, oxidized in liver of sulphur and then lacquered. The lacquer flakes off. This can be overcome, I find, by striking in acid copper solution for about 5 minutes after cyanide plating, but I want to eliminate the acid solution.

A.—It is our opinion that the sulphide, not the lacquer, fails to adhere to the copper plated base, so the lacquer comes with it. The non-adherence of the sulphide or oxide deposit on a copper plate produced in a cyanide solution is due to an excessive use of hyposulphite of soda as a brightening agent. Do not add this factor to your cyanide copper solution. A dull red copper gives the best base for oxidized copper finishes. The coating will then adhere. Add, occasionally, a little caustic potash and bisulphite of soda to the copper solution. You will then obtain satisfactory adherence of the oxide and the lacquer.

One-eighth ounce of caustic potash and ¼ ounce bisulphite of soda per gallon of solution will make a great deal of difference in the copper deposit on the tin tubes. This amount could be added once or twice a week when the copper cyanide solution is constantly operated.

—Charles H. Proctor.

Pin Holes in Nickel Plate

Q.—I am having some difficulty in nickel plating parts for gas stoves. I find that the plate comes out with tiny pin hiles and cannot determine what causes this condition. I am sending you a sample of my solution.

A.—Your solution analyzes as follows:

Nickel	2.04 ozs.
Chloride	trace

Acid to methyl red.

Your solution is in a very poor condition and we are surprised that you are able to do any plating at all. Add to each gallon of the solution 2 ozs. ammonium chloride, 2 ozs. boric acid and 4 ozs. single nickel salts. After these additions have been made, add 6 ozs. ammonium hydroxide for every 100 gallons of solution.

—Oliver J. Sizelove.

Nickel on Cadmium

Q.—We are nickel plating parts which consist of brass formed over steel structures. Prior to nickel plating, the steel structures are cadmium plated. These parts are in our nickel solution from ten to fifteen minutes. We would appreciate your advising us whether or not we are going to suffer any bad effects on our nickel solution by putting these cadmium plated parts into our tanks. We are sending a sample of our solution.

A.—Analysis of your solution is:

Nickel	5.28 oz.
Chloride, as ammonium chloride	3.12 oz.
Ammonium hydroxide	8.31 cc.

Analysis shows this solution to be quite high in metal for a still solution and also too alkaline. We would advise you to discontinue adding any metal until the metal content has become reduced and would also add 3 oz. sulphuric acid to each 100 gallons of solution.

We can see no reason why nickel plating over a cadmium plate will have any bad effect on the nickel solution. Cadmium is added to some nickel solutions to produce a bright deposit. If an excess of cadmium is added, the deposit becomes brittle.

—Oliver J. Sizelove.

Chromium Plating Fundamentals

A Discussion of Chromium Plating in All Its Aspects, Theoretical and Practical—Part 7*

By P. E. EDELMAN

Electrical Engineer

WRITTEN ESPECIALLY FOR BRASS WORLD

BATH ADDITION AGENTS

CHROMIC acid (chromium trioxide), the essential active agent of present day commercial chromium plating baths, is itself a powerful oxidizing agent. The only other ingredient required in the bath is a suitable buffer anion such as the commonly used sulphate ion added in the form of sulphuric acid or chromic sulphate. A variety of other or auxiliary buffer agents have been proposed. These include such diverse additions as boric acid, acetic acid, fluorides, and various other salts. Also extra addition agents aimed to reduce cathode gassing, such as ferrous chrome oxalate, are sometimes employed. The possible agents and combinations for various modified effects have not been exhausted, but data available indicates negative benefit from a large number of the proposed additions. Since the resistance of a commercial chromic acid bath is relatively low (usually less than 1.5 ohm-cm. at 45° C.) many of the proposed addition agents merely increase the resistance. Similarly the chromium dichromate which naturally tends to form during the electrolysis of the bath, also increases the resistance thereof. Small amounts of weak acids such as boric acid have little effect.

CHROMIUM DICHROMATE

The trivalent form of chromium present in baths as chromate is a colloidal agent formed during electrolysis. It is desirable to keep the amount of this naturally formed agent within a minimum range for the good reason that increase of its concentration in the bath is accompanied by corresponding exhaustion of the operatively useful (chromic acid) valency of chromium in the bath as well as by increase in resistance of the bath electrolyte. As the concentration of the trivalent form is favored by iron anodes, lead anodes are preferred by many operators. When the chromium dichromate concentration becomes excessive the bath may be turbid, but before this range is reached, it will be found necessary to increase the applied voltage to overcome the increased resistance drop in the bath until the limit of the generator used is reached. Various methods to control the accumulation of trivalent chromium in the bath have been tried, including even the use of a porous diaphragm according to the early experimental practice in the art. In small shops where hydrometer readings are relied on to check bath strength, the method becomes unreliable as soon as the bath starts to show turbidity from accumulation of the chromium dichromate. Several methods of re-oxidizing are being tried out to control or re-convert this trivalent concentration. While these methods are suitable to a large installation, the small operator can best rely on lead anodes and periodic check on the solution used.

METALLIC SALTS

Various additions of metallic salts, sulphates of other metals, carbonates, and hydroxides are still used by some operators but the benefit of many of these is questionable in the light of accumulated data on behavior of various baths. Some possibility for a fluoride content in the bath has been suggested but no commercial data appears available to prove advantages claimed. Any additions which tend to form precipitates or suspensions in the bath are considered detrimental rather than favorable. The same may be said for proposed addition agents which are attacked and decomposed by the chromic acid of the bath.

ORGANIC CHEMICAL ADDITIONS

Organic substances sometimes used in other plating operations to avoid tree deposits appear to have no benefit in chromium plating, so the use of gelatine, glycerine, etc., is customarily avoided. There are, however, certain organic chemicals which may afford beneficial characteristics in view of extensive studies.

CONVERSION OF CHROMIUM DICHROMATE

For large scale operation, a pump circulated bath may permit conversion of chromium dichromate content back to useful chromic acid and chromic sulphate. The necessary oxidation can thereby be accomplished without interference with normal continuous use of the plating tank. Such auxiliary convertors may prove commercial on large installations.

REVERSIBLE REACTIONS

Various theories of the probable reversible reactions in a commercial chromic acid bath have been advanced. The most obvious conclusions are that a uniform bath composition is desirable. It has been proposed to recover the chemical content lost in spray and drag out, returning same to the mother liquor. It is doubtful if ideal conditions for constant baths can be realized in this manner, though same may be roughly approximated, accompanied by saving the loss of reagents. Probably small operators lose as much of the chromic acid bath in drag out and spray loss as they utilize in plating work. The fact that the plating current causes known electrochemical reactions of which only a part are definitely useful in depositing chromium on the work prompts experimental efforts to reverse the unused reactions as far as practicable in the endeavor to restore initial bath composition. The only definitely necessary loss under ideal conditions with full recovery and reconversion, would be the deposited metal content and the hydrogen and oxygen decomposition gases. Work in this direction is not merely to save materials but rather to maintain constant uniform plating conditions. This is of first importance on large scale operations.

EFFECT OF DIRT AND CONTAMINATED TAP WATER

Tap water known to be hard should not be used in making up chromic acid baths unless its reagent content is definitely determined by analysis and given proper consideration for its proportional buffer action. Some supplies cannot be used at all because they change from time

* Parts 1 to 6 appeared in the issues of August to December, 1928, and January, 1929.

to time due to industrial sewage dumping in the vicinity.

Dirt and sludges do no good and should be periodically removed. Drag-in of chemicals by conveyors not properly washed before immersion in the chromic acid tank must be strictly avoided.

POSSIBILITIES IN DOUBLE BATHS

The possibilities in plural chromium plating baths may receive consideration at this time. It is desirable to work a given bath at uniform operating conditions but advantage may be taken of different operating characteristics of both concentration and temperature range. Thereby different kinds of work can be handled to greater advantage; and in some cases, cascaded tanks may be employed on a conveyor system so that work can be handled in different throwing ranges, first in one plating tank and then in the next one. A rapid change between the tanks will leave sufficient protective liquid and film on the work to permit immediate resumption of plating current in the new bath. Experiments show that a more efficient first dull coating can be followed by a bright coat by this plan. A more interesting possibility, however, is that difficult work can be successfully coated by use of this variation to obtain plating range on recessed articles. Thus, a first plating may be immediately followed by a second, with the first in a bath of moderate concentration and the latter in a concentrated bath.

SHIFT IN CURRENT DENSITY

Similar results can be approximated by (1) pump circulated and changed baths and (2) by shift in current density during plating. The latter is more suitable to small operations and requires but one plating tank. The current density is the one factor permitting rapid shift while other conditions remain substantially constant. The operator has alternative routine to follow. Usually plating is commenced at average mean conditions, keeping the major portion of the work cathode under current density midway between extremes of the particular working range used. Shifts in current density will permit working nearer to one extreme or the other of the plating range to advantage on some work. At the upper range, however, a limitation is met in possible burning of portions of the work.

EFFECT OF OVERVOLTAGE

In handling different cathode and anode metals in a chromic acid bath, consideration is given to the overvoltage, that is to say the different voltages required for gas development at the different metals. Since the work cathode is limited to the metal to be coated as a base, however thin the undercoat may be, there is little possibility for improvement. Attempts have been made to coat recessed articles by applying a thin deposited layer of copper thereon by means of a dip operation prior to plating. As regards the anode, commercially available metals are limited to known examples. There is some possibility in employment of auxiliary anodes. Aluminum suggests itself for special work due to its peculiar properties in electrolytes, but has so far found no commercial adoption due to higher voltage required.

EFFECT OF IRON

Iron accumulations in the bath are considered detrimental in that the resistance of the electrolyte increases therewith. They are caused by use of iron anodes.

pH CONTROL IMPRACTICAL

pH control of chromic acid baths is precluded by the necessity for using strong concentration of chromic acid with a small percentage only of buffer. The amount of control content which could be included for attempted control would be ineffective.

CONDUCTIVITY CONTROL

Good working control of the chromic acid bath is obtainable on basis of the resistance of the electrolyte. It is important to maintain minimum resistance to reduce resistance loss due to high current density used. Recent large scale installations show the result of study of this factor in reducing the voltage required at the plating tank bus bars. As regards the electrolyte itself, the usual tendency is for the resistance to increase with use unless proper correction is made for changes in composition occurring during electrolysis.

GAS PATH IN BATH

The hydrogen evolved at the work cathode deserves more study than has been accorded to it to date. Work should be arranged to facilitate escape of gas with minimum contact dragging along the metal surface. Much gas is occluded during plating.

This series will be continued in an early issue.—Ed.

Zinc Sulphate or Cyanide

Q.—We have a small job galvanizing plant and we are using an old formula which we got from THE METAL INDUSTRY years ago. Your combination consists of zinc sulphate as the base with zinc anodes, 99 per cent or more, and yellow dextrine with sulphate alumina as toning.

We note now that in your recent issues you recommend zinc cyanide solutions with tin, etc. We have considered using cyanide solutions instead of sulphate but have understood it to be more expensive, though this is a question on which we would like to have your opinion.

If we should decide to go to the cyanide solution with or without the tin addition, what is necessary for this? Can you give us formulas and method of procedure to make this change? We want to get the best results possible at minimum cost.

We have considered the cadmium process but the cost of the metal has been too high. It makes the price of work too high for a jobbing plant to use as our customers want work that we furnish at 1½ to 2½ cents per pound. Of course, we want to give them the best rust-proofing possible at these prices.

A.—Considering the two zinc solutions, namely, the cyanide and sulphate, we would hesitate before changing from the sulphate to the cyanide solution. Both give excellent deposits of zinc if properly made and maintained. When cost is considered, the sulphate bath will be found to be the cheapest, while the cyanide solution has a higher efficiency.

A deposit from a sulphate solution has a whiter color. A cyanide solution deposits very well on cast iron, which was practically impossible to do before improvements were made.

We believe that the cost of the solution is the largest factor that you have to deal with, and as the cyanide solution costs about 5 times as much as the sulphate does, you can readily see there would be no saving in changing from the sulphate to the cyanide bath.

—OLIVER J. SIZELOVE.

Soft Cyanide Copper Deposit

Q.—I wonder if you can give me a formula for a cyanide copper deposit that will spread during the buffing operation on such work as radiator shells? I have been using a solution that plates well but the deposit comes out hard and when the shells are buffed the plate does not spread out as I would like it to. What should the free cyanide content of a copper solution be?

A.—There are three factors that make a hard deposit from a cyanide copper solution, namely, low metal content, high cyanide content and too high a current density.

The metal content should be 2.5 ozs. per gallon, with a free cyanide content of 1 oz.

Formula for cyanide copper solution:

Copper cyanide	3½	ozs.
Sodium cyanide	4	ozs.
Carbonate soda	1	oz.
Water	1	gal.

Use solution at 110° F., with 2 volts of current.

There is no reason why your present solution cannot be made to work satisfactorily if you will send sample for analysis.

—Oliver J. Sizelove.

Oxidized Silver Relief Finish

Q.—We are inclosing a finished brass part. We would be grateful if you could give us a plating formula for putting this particular finish on brass parts.

A.—The finish on sample submitted is what is known as an oxidized silver relief finish and is produced by the following method:

The work should be cleansed from grease in an alkaline cleaner, passed through a bright dip, rinsed thoroughly in clean cold water and then plated in nickel solution for 5 minutes, or immersed in a mercury dip for a few seconds.

Then pass through the silver strike, and plate in silve. solution for 30 to 45 minutes.

After silver plating, rinse thoroughly in clean cold water, and blacken in a sulphur solution made of one-half ounce liquid sulphur or one once polysulphide to one gallon of water and use hot.

The next operation is the relieving, and this is accomplished with the use of pumice on either a rag or tampico wheel. Finally, lacquer with a good cotton lacquer.

—Oliver J. Sizelove.

Cleaning Solder

Q.—Please let us know if there is any flux to clean cadmium from solder (new stock). We fluxed out the zinc with sulphur and rosin, but cannot get the cadmium out of this lot of solder metal.

A.—We would suggest the following for removing cadmium from solder:

Heat the bath to a red heat, then agitate the metal by poling, that is, by inserting a stick of green wood to the bottom of the kettle of molten metal and holding it there until it burns away.

Then stir in the sulphur and treat the scum brought to the top by stirring rosin in, and then skim the metal. Add a handful of flux composed of 50% sulphur, 25% sal ammoniac and 25% rosin. Stir well.

Cadmium is much more volatile than zinc, and this process should eliminate cadmium when present in small amounts since it readily volatilizes. —W. J. Reardon.

Excess of Sulphate in Chromium Bath

Q.—I am experimenting with chromium and have a 10-gallon test solution made up on one of the formulas you have published.

It contains 33 ozs. of chromic acid and 3 ozs. sulphuric acid to each gallon. At 150 amperes, 6 volts it plates fine on small articles but I tried it on a heavy hub cap and also on switch parts and it failed to deposit.

A.—We do not know who has made the mistake, but your formula should call for 33 ozs. chromic acid and 0.3 oz. (three-tenths ounce by weight) of sulphuric acid, to each gallon.

Using 3 ounces of sulphuric acid to the gallon has given your solution an excess of sulphate, which decreases the throwing power of the solution.

You can precipitate the sulphate in your solution by adding freshly prepared barium chromate. Then add the correct amount of sulphuric acid again.

—Oliver J. Sizelove.

Stoneware Acid Holders and Baskets

The U. S. Stoneware Company, operating a plant at Akron, Ohio, and New York district offices at 52 Church Street, New York City, produces a complete line of acid-proof vessels, baskets, tanks, etc., for industrial use. The line is varied and covers most types of containers needed in plating and finishing plants, pickling rooms and other operations requiring strong acids or other corrosive chemicals.

The company makes pots for containing acids, alkalis or other corrosive substances, which are stated to be highly heat-resistant and the vessels are made with or without glaze.

Various Types of Acid-Proof Stoneware

These are made in regular sizes ranging from 5 to 60 gallons, from 11 to 24 inches inside diameter and from 14 to 31½ inches high. Covers and special sizes are also available, up to 300 gallon capacity. Dipping baskets of strong, non-porous vitrified chemical stoneware are made in a variety of sizes and shapes, with handles such as are shown in the illustration herewith. Acid pitchers of chemical stoneware are made in 2 quart, 1 gallon and 2 gallon sizes. It is stated that these have long pouring lips and well fitted handles.

The makers state that these products are suitable for plating and finishing plants. In this regard it might also be stated that the company produces a line of one-piece, vitrified stoneware, acid-proof tanks for electroplating, galvanizing, pickling, etc. They are made in sizes ranging from 4 to 119 gallons, and also in special sizes to order.

The tanks are rectangular in shape and are made with or without glaze. The company states that these are guaranteed to be acid and corrosion proof, and in every way suitable for plating purposes.

Bright Nickel Solution

Q.—I am plating electrical fixtures and cheap coffin hardware. I need the formula for a bright nickel solution for such work, to go under a bright silver plate. I have a nickel solution now, but when a heavy silver deposit is put over the nickel deposit which this solution produces, the nickel tends to peel off.

A.—The following formula will give a very bright deposit of nickel if the basic metal surface upon which the nickel is to be deposited is as bright as possible when immersed in the solution:

Water	1 gal.
Single nickel salts	12 ozs.
Nickel chloride	1 oz.
Boracic acid	2 ozs.
Ammonium chloride	2 ozs.
Cadmium sulphate	1 grain

Temperature of solution, 80° F. At 4 volts an unusually high amperage can be used with this solution; test plates gave 35 amperes per sq. ft. of surface.

The addition of cadmium can be increased up to 5 grains per gallon for very bright nickel deposits. This amount of cadmium, however, should not be exceeded, and additions should only be made in the minimum amounts when the nickel deposit shows an indication of becoming dull again.

The addition of small amounts of pure hydrochloric acid as free acid at frequent intervals is an advantage, but not more than ⅛ oz. per gallon at one time. The upkeep can be primarily made on the basis of:

Single nickel salts	1 lb.
Nickel chloride	2 to 4 ozs.
Ammonium chloride	2 ozs.

Using sufficient hot water for solution, as many pounds of the above combination may be added to the solution as may be indicated by results obtained from the solution, but primarily indicated by current conditions.

Some firms purchase the cadmium metal in sticks about 6 inches long or more, ½ to ¾ inch diameter. The codium metal is connected as anode and used as the brightening agent at intervals when the solution denotes that cadmium is required. Care, however, should be exercised not to get too much cadmium in the solution as such a condition produces a yellowish tone in the nickel and also induces a brittle deposit.

—Charles H. Proctor.

Non-Inflammable Kerosene

Q.—Our superintendent is under the impression that at some time he has read in your magazine an article on how to make kerosene non-inflammable. We will appreciate it if you can give us any information on this point, and oblige.

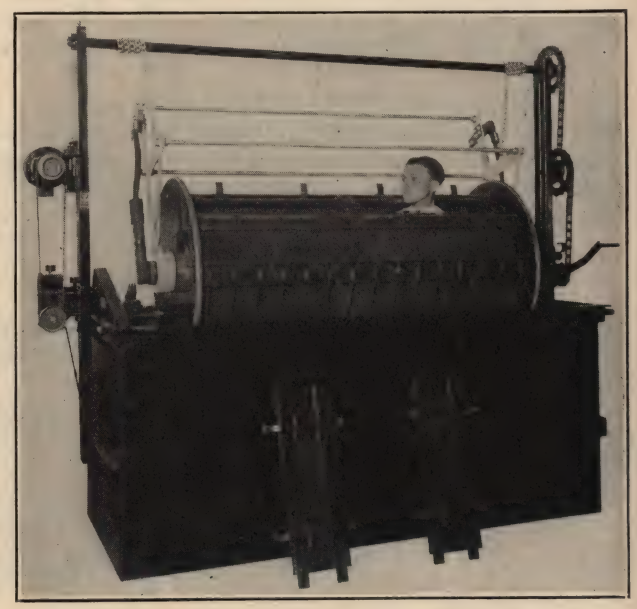
A.—We do not remember mentioning a non-inflammable kerosene oil. We have, however, mentioned the production of non-inflammable gasoline or benzene. The same factors would produce a non-inflammable kerosene: 40 parts by measure of gasoline or benzene and 60 parts by measure of carbontetrachloride or trichlorethylene produces a non-inflammable mixture. Considerably less of the materials would be required for kerosene. Try 75 parts kerosene and 25 parts of either non-inflammable solvent mentioned. Make your test carefully, in the open air. If the mixture does not ignite when a flame is placed in or to the mixture, it will be non-inflammable.

—Charles H. Proctor.

Extra-Size Plating Barrel

Lasalco, Inc., St. Louis, Mo., announces the development of a mechanical barrel for electroplating which has a 400-gallon solution capacity and capable of plating 700 to 800 pounds of work at a load. This is the largest barrel the company has yet put out, but it is in practically all respects the same as the company's other barrels in construction. The barrel shown here with a boy sitting in it to indicate the depth of the cylinder, has inside dimensions of 7 by 3 by 3 feet. The cylinder is 24 inches in diameter and 60 inches long, of all formica construction.

In regard to this development, the makers state that earlier attempts to make a barrel of this size have been baffled by the fact that it was not possible to make such a barrel that would plate the large amount of work it could take in the same length of time that a smaller-capacity barrel would plate its smaller load. There was, they state, a tendency for the length of plating time to increase as the size of the mechanism was expanded. The new barrel, they claim, will operate as rapidly as the smaller machines of this type. Smaller Lasalco barrels, it is stated, have always been found rapid and efficient, and the new large machine is said to be the same in this respect.



Large Type Plating Barrel

The company states that another new development along the same line but, paradoxical as it may seem, in another direction, is a pigmy plating barrel which will be the smallest yet produced, while retain the principles of the company's regular line of mechanical plating equipment.

Generator Size for Chromium Bath

Q.—Please let me know if a 2,000 ampere motor-generator set is large enough to take care of a chromium tank measuring 72 in. long, 24 in. wide and 36 in. deep.

A.—The proper size generator for a 250 gallon chromium solution would depend upon the amount of surface that was to be plated. Usually it requires from 150 to 200 amperes per square foot of cathode surface. Not knowing what class of work you are going to plate, we would say that a 2,000 ampere machine would be large enough for any work, with the exception of large sheet work.

—Oliver J. Sizelove.

New York Platers Hold Annual Session and Banquet

Practical Experience as Well as Research Are Covered in a Fine Array of Papers on Various Phases of the Plating Industry

THE New York Branch of the American Electroplaters' Society held its annual educational session and banquet on February 16, 1929, at the Aldine Club, 200 Fifth Avenue, New York City. About five hundred persons were present for the banquet in the evening and a considerable number of these were present during the afternoon activities, consisting mainly of the educational session.

The session was animated by lively discussion of the excellent papers presented. The meeting was opened by short addresses of welcome by Frederick Haushalter, chairman of the banquet committee; Frank J. Mac Stoker, president of the New York Branch, and Charles H. Proctor, founder of the American Electroplaters' Society, who presided over the session. The papers read were as follows:

Flexibility and Adhesion in Modern Lacquers, by Leo Roon, technical director, Roxalin Flexible Lacquer Company, Long Island City, N. Y. Mr. Roon's paper was supplemented by a number of exhibits which demonstrated differences in various kinds of lacquers, with a view to showing the value and desirability of three particular qualities in lacquers for metals, viz.: adhesion, durability and flexibility. He stressed the value of new methods of application developed in recent years by lacquer manufacturers and the benefits to be derived by scientific handling of this material. He stated that the plater and finisher will profit by giving attention to new lacquers developed for coating metals, and urged that they consider the representations of makers of lacquers.

Factors that Control Chromium Plating, by Oliver J. Sizelove, chemical editor, THE METAL INDUSTRY, New York City. This paper gave an accurate detailed outline of the subject, stating that careful control is the chief necessity for proper deposition of chromium and that platers will find it necessary to exercise such control if they are to succeed with chromium. He gave full credit to research workers in chromium, mentioning especially Dr. William Blum of the United States Bureau of Standards, and Richard Schneidewind and associates at the University of Michigan, Ann Arbor. The paper then gave a number of observations which have resulted from considerable experimentation and practical application, paying particular attention to such factors as temperature, current density, chromic acid concentration, trivalent chromium, anodes and anode corrosion, sulphate and other details. Mr. Sizelove voiced the opinion that the plater need not be either an expert chemist or an electrician, but that he must of necessity have information along both of those lines for successful operation of chromium solutions. He presented the opinion that lead anodes are equal to the combination of lead and iron anodes.

In discussion of the paper, Mr. Proctor stated that in his experience he had found the use of iron anodes in addition to lead quite as efficient as lead alone, and that he had observed similar practice in plants in the Middle West. However, the question is still a debatable one and no completely definite conclusion has as yet been reached, he said.

Simplified Methods of Chemical Control, by Dr. C. L. Pan, instructor in electroplating, College of the City of New York. Dr. Pan's paper was highly instructive, presenting an involved and important phase of the plater's work in terms readily understood by those not well versed in technology. By means of charts, he explained several easily applied methods of determining various factors in plating solutions, such as acid content, pH, free cyanide or free alkali content, free metal content and metal in solution, etc. He explained that since most practical platers prefer not to make involved mathematical calculations if they can be avoided, the use of these charts is very desirable. His paper was very well received and several of those present, including Mr. Proctor and George B. Hogaboom, well known plating expert, paid high tribute to Dr. Pan's demonstration.

Mechanical Plating Methods and Formulæ. F. J. Mac Stoker and W. Strein. This paper discussed from a practical viewpoint the subject of mechanical electroplating of a very wide variety of small articles with an equally wide variety of finishes. The various methods employed were detailed just as performed where the authors of the paper have charge of a large plant, and many interesting points were brought out. Of particular note was the statement that preparaion of the work is usually the most difficult part of it, and that only cold solutions, rinses, cleaning dips, etc., are used at this plant. No heat is used in any of the operations, means having been found to perform all the work at normal temperature. The paper was supplemented by a large exhibit of all kinds of finishes produced, including copper, brass, nickel, cadmium, galvanized, Parkerized, blued steel, and several black finishes.

Following the papers there were short addresses by a number of men who were called upon by Mr. Proctor. **Horace H. Smith,** Supreme President, greeted the members and invited all to attend an all-day session to be held by the Newark Branch on April 6, 1929, which will be followed by that Branch's annual banquet.

There was a report on the **Research Committee** of the Society. It was stated that the next Research Conference is to be held at Newark, as part of the all-day session there on April 6, instead of Washington as in the past.

There were further remarks by Messrs. Hogaboom, Gehling, Mesle and Dr. Blum.

The crowning event of the brilliant day was the annual banquet, where the combination of fine food, music and general good spirits on the part of everyone made it a memorable occasion. Dancing followed the dinner.

There were delegations from several other branches, including Newark, Philadelphia, Bridgeport and Baltimore-Washington.

Nickel Plating Die Cast Metal

Q.—I would like to have a good formula for nickel plating die cast articles. What is being used generally today? What is the procedure, roughly outlined?

A.—Formula for nickel solution for die cast metal:

Double nickel salts	10 ozs.
Sodium chloride	7 ozs.
Boric acid	2 ozs.
Sodium citrate	1 oz.
Water	1 gal.

Temperature, 80° F. Strike with 4 volts for few seconds, then reduce to 2 volts. A 10-minute deposit is considered a good deposit and one that will stand color buffing well.

Work should be cleansed in a mild alkali cleanser, rinsed in clean water, passed through a cyanide dip, rinsed in clean cold water, and plated directly in nickel solution.

—Oliver J. Sizelove.

Electro-Tin Solution

Q.—We desire to make up an electro-tin plating solution of about ten gallons and would thank you to give us the best formula for a good white plate, stating just how to mix and voltage required and any other information necessary.

A.—The following formula for an electro-tin solution will give excellent results:

Sodium stannate	28 ozs.
White oxide tin	2 ozs.
Starch	⅛ oz.
Water	1 gal.

Dissolve starch in warm water before adding to the solution. Temperature, 130° to 150° F.; 3 to 6 volts. Use pure tin anodes and iron anodes, with steel hooks, in equal proportions.

—Oliver J. Sizelove.

Carding Wax

Q.—I am enclosing a sample of carding wax, which is used by dental manufacturers for sticking sample artificial teeth on cards, and hence the name. It is a parafine product and is colored. It has a structure and fibre like taffy candy that is "pulled" to make it homogeneous and "chewy." The wax has the property of being somewhat plastic at about body heat, 95 to 100° Fahrenheit. I wonder if you can give me a formula for such a wax.

A.—The only data we can give covering the possible production of a similar wax is found on page 603, Scientific American Encyclopedia, "Local Notes and Queries," under the caption of "Dentists' Molding Wax," which is as follows:

Stearic acid	25 parts
Half soft copal	25 parts
Talc	50 parts
Carmine	½ part
Oil of rose geranium	2 drops to 1 oz.

Melt the gum copal by heat of a sand bath; when slightly cooled, add the stearine, stirring constantly. When this has melted, add the other ingredients, previously intimately mixed so that a homogeneous product is obtained. The adhesiveness of the composition may be increased or diminished by modification of the amount of copal.

—Charles H. Proctor.

Burnt Brass Finish

Q.—We are sending you a sample furniture pull. We are having a little trouble procuring this particular finish. Will you kindly advise us what to use for this finishü

A.—The sample brass pull you have submitted is presumably produced by the aid of golden sulphuret of antimony and 26° aqua ammonia. In the furniture hardware trade, it is called the Old English or burnt brass finish. The method used in its production is as follows:

The brass should be either bright acid-dipped or cut down with Tripoli and usual muslin buffs.

The article should be cleansed as for plating, then immersed in a dip prepared by adding golden sulphuret of antimony to 26° aqua ammonia until a semi-plastic solution results. The solution should be prepared in an earthenware stone jar of suitable dimensions. The jar should then be placed in hot water tank and kept surrounded with water heated to 200 deg. F., to maintain a uniform temperature.

The articles to be finished should be immersed in the solution on copper or brass wires, in quantities, for a short time, then removed and left to drain. When partly dry, immerse them in cold and boiling waters and dry out. Relieve the highlights with small felt wheels to which is applied minute quantities of Tripoli or white polishing composition. Afterwards lacquer.

The original method was to apply the antimony and ammonia paste with a brush; then the articles were heated in a lacquer oven for a time; the excess coating was brushed off and relieved and finished as outlined. This method was too slow so the immersion method was adopted.

—Charles H. Proctor.

Making Hydrogen Peroxide

Q.—Please give me a method producing hydrogen peroxide. I had it once and it worked very well in the control of pitting.

A.—To produce hydrogen peroxide solution for the control of hydrogen pitting, proceed as follows:

In 1½ gallons of pure water heated to 110° F., dissolve 1 lb. sodium perborate. Mix thoroughly, then let cool down to about 80° F. Add pure muriatic acid to the solution until it becomes faintly acid in a blue litmus paper test. The litmus paper should only change to a violet or very faint pink in color.

This amount of sodium perborate converted into hydrogen peroxide will be ample for from 250 to 1,000 gallons of nickel solution that gives hydrogen pitting.

The addition of a pint per day to each 250 gallons of nickel solution should eliminate any danger of pitting.

—Charles H. Proctor.

Neutralizing Acid Water

Q.—We are making changes in our plating room and would appreciate information as to a method of neutralizing acid water to prevent rusting the drain pipes, both underground and exposed.

A.—The best answer would be to use lead pipe or iron pipe lined with lead. A tank could, however, be arranged, into which the acid waters could flow and be connected with an overflow to the sewers. Ordinary soda ash could be used to neutralize the acid waters. The amount required per 100 gallons of water will have to be decided by test, using blue litmus paper; when the blue litmus paper no longer becomes red, pink or even violet, the water is neutral enough.

The use of lead pipes, however, is the cheapest way out.

—Charles H. Proctor.

BRASS WORLD

And Plating — Polishing — Finishing

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Chromium Prices

WHILE various phases of the chromium plating business have still to be perfected and placed on a practical and commercially economic basis, so great has been the advance in this remarkable new field that already it gives evidence of developing some of the problems which attend the progress of any important industry.

By some there has been raised the question of whether there are not too many platers engaged in deposition of chromium. We rather doubt that there are already too many in the industry. But we do not overlook the fact that there is a considerable number, and that this number is expanding. And this tendency, in any industry, always gives rise to speculation as to what the effect of strenuous competition for business will be. It is almost axiomatic that supply, demand and prices are constantly related in any field where competition is open and practically compulsory, as it is under the laws of this country. Thus, ask some, what will happen to chromium prices with so many rushing for business? We ask this, too, and in addition, we want to know what will happen to chromium quality if prices are minimized?

The chromium industry being as young as it is, there is still ample opportunity to avoid the great mistake of driving away public confidence by selling a product that is poor because competition in the industry cuts prices to a point where only a poor product can be marketed at a profit. Such a situation is easier to avoid than to remedy, and it will be avoided as long as all in the industry remember that its existence depends upon the consumer's confidence in the product; that prices must permit quality of product.

Pattern Storage Costs

THE cost of storing patterns is, in these days of accurate cost-finding and strict adherence to systematic practice, a large item on the books of the foundry. It is costly to keep too many old patterns in stock, especially when additional buildings are needed to hold them. What to do with idle and obsolete patterns, therefore, is no mere academic consideration; and it has been given very enlightening study by several organizations in the foundry industry, and their activities in this direction are summed up, together with the results of some original work in the same direction, by the Policyholders' Service Bureau of the Metropolitan Life Insurance Company, which has done considerable research on improved foundry practice.

The term "obsolete" has been defined ordinarily as having gone out of use. With patterns, however, this must be somewhat modified in the light of the type of work and the nature of the product. A pattern that is obsolete in one line might still be active in another. Where replacement of parts is required long after the product is made, patterns necessarily remain active longer than where there is no such replacement factor. In some cases, even where a pattern might be needed a very long time after it is made and used, the high cost of storage might warrant its destruction after a certain period of disuse, despite the possible necessity of reproduction when the pattern is wanted. Here a comparison of the cost of reproduction with cost of storage usually indicates the proper procedure. Some companies have fixed a definite period of inactivity for patterns, after which they are destroyed. Jobbing foundries vary in their procedure, some retaining customers' patterns indefinitely, some writing a storage period into the contract, after the expiration of which a storage charge is made. The card index system of tabulating patterns has been found to have great merit. In all, the study is well worth the attention of foundrymen.

Questions and Answers

All inquiries are considered in the order received and the answers published in the next regular issue whenever possible

Cleaning Galvanized Surfaces

Q.—Is there any way to clean galvanized cross arm braces that have turned black from exposure to the weather? I would like to use a dipping solution that would brighten them without removing the zinc coating.

A.—There is no chemical method that I know of whereby oxidized zinc may be cleaned. You will be compelled to resort to mechanical means and would suggest that you use a crimped iron wire wheel 6 inches in diameter and operated at 1400 R. P. M.

—Oliver J. Sizelove.

Chromium Installation

Q.—I would like to have full information on installation and operation of a chromium solution. Please let me know what kind of tanks to use; whether work should be nickel plated before chromium plating; what current is used; what length of time to chromium plate; whether to keep chromium plating outfit in separate room from nickel; how to protect men from fumes; if solution is used hot or cold; what anodes are used; best kind of installation for 200-gallon solution to plate wrenches.

A.—To install a 200-gallon chromium solution to plate wrenches, the following suggestions are offered:

The work should be nickel plated and nickel colored before plating with chromium.

To produce a nickel deposit that will not raise when chromium is deposited on the nickel requires much care in the control of the nickel solution, for the deposit must be soft and adherent. A soft nickel deposit can be produced in the following solution:

Double nickel salts	8 ozs.
Single nickel salts	4 ozs.
Boric acid	2 ozs.
Ammonium chloride	2 ozs.
Water	1 gal.

Temperature, 100° F. pH, 6 to 6.2; amperage, 20 per square foot.

Formula for chromium solution:

Chromic acid	55 ozs.
Sulphuric acid	0.5 ozs. by weight
Water	1 gal.

Temperature, 105° F. Amperage, 75 to 100 per square foot.

Use iron tank, glass or slate lined, with lead anodes. Tank should be equipped with proper exhaust system to take care of the gases that are given off as these are dangerous to the membranes of the nose. It is not necessary to have chromium plating outfit in a separate room, but it would be advisable to have a separate supply of current so that the amperage can be properly controlled.

Should you have trouble with your nickel deposit raising, send a 2-oz. sample bottle to us for analysis.

—Oliver J. Sizelove.

Chromium Solution Analysis

Q.—How does one go about analyzing a plating solution?

A.—Write to the United States Bureau of Standards, Washington, D. C., for a copy of Technologic Paper No. 346 (price, 15 cents) which contains a complete method for the analysis of chromium solutions, besides other valuable data on chromium plating.

—Oliver J. Sizelove.

Defective Chromium Solutions

Q.—We are shipping you three samples of our chromium solutions. The jars contain solutions from three different tanks.

We have done considerable experimenting with these solutions, adding various ingredients in our attempts to make them function properly, and we believe that we have spoiled these solutions.

We are wondering if you are in a position to analyze these solutions carefully and advise us what ingredient it would be necessary for us to add in order to put them back in perfect running order? Please report to us on each separate solution as numbered.

Analysis of chromium solutions:

1.	Chromic acid	52 ozs.
	Tri-valent chromium	9 ozs.
	Sulphuric acid	1.63 ozs.
2.	Chromic acid	70 ozs.
	Tri-valent chromium	6.6 ozs.
	Sulphuric acid	2.16 ozs.
3.	Chromic acid	36 ozs.
	Tri-valent chromium	.8 oz.
	Sulphuric acid	1.6 ozs.

A.—Solutions 1 and 2 are in very poor condition. The tri-valent chromium and sulphate contents are high in all three solutions. So is the chromic acid content in No. 2 solution.

Before solution No. 1 can be made to produce satisfactory results the sulphate and tri-valent contents must be reduced. The sulphate content may be reduced by precipitation with freshly prepared barium chromate. It is best to add sufficient to precipitate all the sulphates and then add the correct amount of sulphuric acid, which would be approximately ½ oz. by weight, per gallon of solution. To decrease the tri-valent chromium content, procure a porous pot, fill it with a solution made by dissolving 2 pounds of chromic acid to one gallon of water, hang porous pot on cathode rod with insulated wire, suspend into porous pot a sheet of lead and connect lead with cathode rod and use a high voltage. It will take quite some time, probably several days, to decrease the amount that is present in your solution to a point where solution will work properly.

After you have followed the above recommendations

for No. 1 solution, advise me as to results and send another sample for analysis. A 2 or 3-oz. bottle will hold sufficient solution for analysis.

Solution No. 2 should be reduced one-third; the sulphate and tri-valent chromium contents should be reduced by same method as outlined above.

Solution No. 3 is low in chromic acid. After reducing the sulphate and tri-valent chromium contents add 1 lb. chromic acid per gallon.

Our advice would be even more complete if you had stated the types of baths you have; the kind of anodes used; and the class of work plated.

—Oliver J. Sizelove.

Electroforming Methods

Q.—We are interested in electroforming and would appreciate information on the subject.

We have very finely etched copper molds on which we copper deposit. Our chief difficulty has been in securing separation of the deposited metal. We have ruined several original copper plates, which are very costly. This has been due to adherence of the deposit. We used ether and alcohol with beeswax in very thin liquid form, and when dry we rubbed in plumbago. Because we must insure perfection in the reproduction we have to rub most of the plumbago off. Langbein, and also Hogaboom, in their books, speak of iodized silvering. What is your experienced opinion?

A.—Your method of preparing the finely etched copper mold for plating is wrong. The method in general use consists of forming an iodide of copper on the mold before copper plating so that the deposit may be separated from the mold easily.

Prepare the iodide solution in the following way: To every ounce of potassium iodide use 3⅓ ozs. of alcohol. Stir well until all the iodide is dissolved and then coat the surface of the mold with the solution either by flowing the solution over the surface or by using a sponge or soft cloth. Rinse thoroughly in clean, cold water and place in copper plating solution. When the copper is deposited to the desired thickness, loosen carefully around edge of mold and you should have no trouble with the copper deposit adhering to the mold provided that the engraving is not undercut too heavily.

—Oliver J. Sizelove.

Electroplating Equipment

Q.—We have a small shop employing five men and most of our work must be replated, such as bar pins, rings, chains, etc. We have an electroplating outfit supplied with direct current; in other words, seven carbon lights erected in series, cutting down the 110 volts direct current to six and 45 volts. We do most of our plating with 45 volts. I do not know how many amperes we use. This hook-up is used in all the small shops and most of the plating is guesswork. The solutions we use are yellow gold, dark green, light green, white gold, platinum and silver, and are all in two-quart containers made of enameled iron. A two-quart solution is large enough for our work.

We manage to get the small articles plated fairly good by plating one article at a time, but as soon as we try to plate a large article it will not work.

Kindly send us information on an inexpensive hookup that will plate articles as large as mesh bags; the best method of stripping small articles; how to test for amperes. Is it necessary to have a generator? We have direct current, 110 volts.

A.—It is considered very poor plating practice to supply the electric current from the source that you are using. The amperage, that factor upon which the character of the deposit depends so greatly, is necessarily very limited when taken from a 110 volt light circuit, and 45 volts is entirely too high to use for electroplating purposes.

If the installation of a small generator to supply the current is too expensive, we would suggest the use of a storage battery. These can be bought very cheaply and we believe that one rated at 6 volts and 100 amperes would be sufficient for your work.

It is advisable to place in the circuit a rheostat, volt meter, and ammeter, so that you can have proper control of the current.

To strip gold and silver use the following solution:

Yellow prussiate potash	2 ozs.
Sodium cyanide	6 ozs.
Water	1 gal.

Use solution at 120°F., 6 volts and the reverse current. Lead cathodes.

—Oliver J. Sizelove.

Making Thin Cores

Q.—Is there anything else than sand to use in making a core that is 3-16 in. thick and 14 in. long? We have been having trouble producing such a core with a core machine and thought that perhaps some material other than sand would give better results.

A.—We regret that we know of nothing to take the place of sand in making cores around which brass or iron is to be cast. We agree with you that it is exceedingly troublesome to make a core 3-16 by 14 in. However, it is the best method we have today and sand is about the only material used.

—W. J. Reardon.

Time for Chromium Plating

Q.—At your convenience I would appreciate you advising me the amount of time required to deposit a chromium plate.

A.—Assuming proper composition of the solution and a knowledge of current density and temperature requirements, the time necessary to deposit chromium is entirely dependent upon what you are trying to accomplish. For most jobbing work the complete covering of the surface with chromium is sufficient. This is generally accomplished, with proper rack design, in 5 minutes. For a better grade of work, 10 minutes is seldom exceeded because after that the edges begin to cloud up, requiring coloring. When chromium is deposited on dies, punches, etc., to increase life of machine tools, one-half hour is the customary deposit.

—Joseph Haas.

Nickel Deposit for Burnishing

Q.—Will you please criticize the formula below and tell us if in your opinion this will produce a bright, soft nickel deposit that will be suitable for ball burnishing in mechanical equipment? We are of the opinion that this solution will produce the proper plate for such a burnishing operation and wish to have your opinion in the matter. The formula is:

Water	1 gal.
Single nickel salts	8 ozs.
Boracic acid	1 oz.
Epsom salts	1 oz.
Common salt	½ oz.

When replenishing the solution, use only single nickel salts and boracic acid. To every pound of single nickel

salts add two ounces of boracic acid. Boracic acid should be dissolved in boiling water as it dissolves very slowly even in warm water. Use a still tank; voltage 6 to 8.

A.—We would not recommend a nickel solution to be made from formula given, especially for ball burnishing. A solution made from this formula would contain 1.6 ozs. of metal per gallon. It would not contain enough chlorides to give proper anode corrosion and would have a pH of about 5.4, depending upon the acid content of the nickel salts. This would produce a deposit entirely too hard for ball burnishing.

A solution made from the following formula will give excellent result:

Double nickel salts	8 ozs.
Single nickel salts	4 ozs.
Ammonium chloride	2 ozs.
Boric acid	2 ozs.
Water	1 gal.

Use at 80°F., with 2½ to 3 volts for still tank work. Solution should be analyzed before replenishing and then you will know exactly what to add and how much of each constituent.

—Oliver J. Sizelove.

Plating Plaster Molds

Q.—We would like very much to know the latest methods for plating plaster molds. We understand that a great deal of this work is being done in various parts of the country. We have used stearic acid in connection with electrotypers' bronze powder and common bronzing liquid for a medium with very little success. The stearic acid seems to crack the plaster and is very costly.

We would appreciate your opinion relative to this class of work, including the mixture used for plaster and the plating process.

There is a large amount of this class of work that our shop could get to do, providing we could do it economically and satisfactorily.

A.—Stearic acid is not generally used to make the mold impervious to fluids. Beeswax, which is dissolved in turpentine, is being given preference.

After the mold is waxed and allowed to dry, it is metallized by applying with the spray gun a mixture of copper bronze powder and bronzing liquid. Upon the quality of the copper bronze powder and bronzing liquid used, depends greatly the metalizing effect produced.

Langbein's book on "Deposition of Metals" contains a general outline of the procedure for galvanoplastic work.

—Oliver J. Sizelove.

Plating Room Floors

Q.—We will appreciate it very much if you will advise us the proper kind of a floor for a plating room over a basement. Our present plating room has a concrete floor and we note that after only a few years' service the concrete has disintegrated. This room is not over a basement and of course it did not matter if the solutions did leak through the floor as nothing would be harmed.

Now we are figuring on increasing the size of our plating room and installing it in an addition which we contemplate building. There will be a basement under the new plating room and we are interested in knowing the proper kind of a floor to put down. One that will prevent any leakage and also stand the wear is what we want.

The floor we are contemplating will cover a space of about 30 x 40 feet and we had in mind concrete slabs several inches thick, covered with asphaltum about 1 inch or 1½ inches thick. We certainly will appreciate it if you will send us any information on this subject that you have.

A.—The floor, if made of wood, should be made waterproof by using 3 ply tar paper which is coated with asphalt. Concrete is then put over the waterproofing and a grade established with the concrete. This grade should be about 1/16 inch per foot. On top of concrete a 2 ply coat of roofing tar paper is laid and coated with asphalt. On top of this is placed an inch layer of a mastic asphalt composition, which can be procured from the Johns-Manville Company. This composition is harder than the common asphalt and will not soften with hot water.

—Oliver J. Sizelove.

Protecting Floodlights

Q.—We manufacture floodlights for outdoor use. The casing is made of Armco iron. We wish to cover the iron with the best coating possible. The cases will not get hotter than 250°F. The appearance is secondary, as they will be painted. The idea is to get a good protective coating to prevent rusting.

We are considering three different methods, ie.:

1. Galvanizing (hot)
2. Leading (hot dip)
3. Cadmium plating.

In your opinion, which will give the longest life?

A.—Of course, cost is a factor in your product, and, considering that, we are of the opinion that hot galvanizing will give you the best results. The heavier coating of zinc obtained in hot galvanizing will compensate for the closer grained deposit that you would obtain in cadmium plating. We recommend this on the basis that you are painting over the flood lights and appearance is no factor. We recommend hot galvanizing in place of hot leading because of the known superiority of a zinc coating over a lead coating to prevent rusting.

—Joseph Haas.

Tin Plating

Q.—Please furnish us with a formula for plating tin on small articles such as brass buttons, spring clips, contact-springs, brass slugs, etc. We prefer the article to have the appearance of the finish obtained with Hoke tin white finish. This, however, is too expensive to purchase in the small quantities offered. We also would prefer to have the salts ready mixed, without the addition of more than a very small amount of water, so that the additions of water will make a ready solution at once. This will prevent making up new solutions every few days, as it seems all tin solutions quickly deteriorate.

A.—Small work such as you mention is usually tinned by the immersion method, which is as follows:

Procure a steel or cast iron tank with steam coils on bottom. Cover steam coils with a piece of ¼ inch iron wire mesh. Over this mesh place mossy tin to depth of 1 inch. Now make tin solution as follows:

Caustic soda	12 ozs.
Tin chloride	4 ozs.
Sodium chloride	1 oz.
Water	1 gal.

Fill tank half full with this solution and place work in brass baskets into the tin solution. It is best to separate work in baskets by placing perforated tin plate. Boil tin solution for 10 or 15 minutes, when articles will be coated with a nice white coat of tin. Rinse in clean, cold water, and dry in hardwood sawdust.

Replenish tin solution by adding chemicals as given in formula. If an electro-tin is desired, use the following:

Sodium stannate	28 ozs.
White oxide tin	2 ozs.
Water	1 gal.

Put in ⅛ oz. starch to each gallon as brightener. Dissolve starch in warm water. Use 3 to 6 volts; plate at 130° to 160° F. Use pure tin anodes with iron hooks. Use ½ tin anodes and ½ iron anodes.

—Oliver J. Sizelove.

Silver Deposits on Glass

Q.—Where can I obtain full information on the deposition of silver on glass Are there any books or pamphlets on the subject?

Can you tell me an easy way to precipitate silver with nitric acid from its ordinary form in bars or ingots into a mushy state by putting strips of copper, or suspending them, in it to recover the silver from the precipitation?

A.—There is no complete treatise published on the deposition of silver on glass, but an article published by A. A. Le Fort in the February, 1913, issue of The Metal Industry deals with the subject from a practical work shop viewpoint.

There was also an article published by Howard Pearsals in the June, 1918, issue of Brass World which is well worth reading. We believe you can get all the information you need from these two articles.

—Oliver J. Sizelove.

Wire for Stringing Work

Q.—Will you please advise us whether iron stringing wire is detrimental to a nickel solution? We have always used copper stringing wire, but lately we have experimented with iron wire on account of the cost. We wish to be sure it will not harm our plating solution.

A.—Of the two metals, iron and copper, we are of the opinion that copper is the more detrimental. If you had no trouble due to accumulation of copper, there is no reason why you should have any difficulty due to accumulation of iron.

However, we firmly believe that the substitution of iron wire in place of copper wire for stringing up articles for plating is false economy. In the first place, the iron wire is stiffer, slowing up the stringing and therefore the filling up of the tanks with work. Again, with the same thickness of the two wires, copper is six times as conductive as iron. To obtain the same deposit of metal with iron wire as with copper wire in the same time, you would have to have either the iron wire six times the diameter of the copper wire, or your current density six times as high; or leave the work in six times as long.

If you don't consider the above factors you may have more cut-through work in coloring and then where would the economy be? The above statements are made with due consideration of the high and advancing price of copper.

—Joseph Haas.

Associations and Societies

American Electroplaters' Society

Baltimore-Washington Branch

HEADQUARTERS, CARE OF G. F. P. TURNER, 5324 MAPLE AVENUE, BALTIMORE, MARYLAND

Annual Meeting and Banquet

Only a brief report was possible in the previous issue regarding the first annual educational session and banquet of the Baltimore-Washington Branch of the American Electroplaters' Society, held at the Emerson Hotel, Baltimore, on January 26. The attendance was larger than expected and the program of activities was very fine, especially in view of the fact that the Branch was organized only a few months ago. The educational session was in charge of Dr. William Blum, electroplating expert at the United States Bureau of Standards, who has taken an active part in the organization and operation of this branch. He read a letter from Charles H. Proctor, founder of the Society, which gave a good outline of the history of chromium plating. Dr. Blum followed this with some remarks on research in chromium. The other papers were as follows:

Chromium Plating Methods, by Oliver J. Sizelove, chemical editor, The Metal Industry, New York City.

General Application of Chromium Plating, by George B. Hogaboom.

Application of Chromium in Ordnance, by A. J. McKinney, United States Navy Yard, Washington, D. C.

Chromium on Printing Plates, by R. H. Slattery, United States Bureau of Printing and Engraving, Washington, D. C.

The banquet, attended by 111 persons, was a gay affair, with singing and other entertainment, especially by Messrs. Garrison and Slattery. Several delegations from other branches were present, a large one from Newark, N. J., being headed by **Horace H. Smith,** Supreme President of the American Electroplaters' Society.

Newark Branch

HEADQUARTERS, CARE OF ROYAL F. CLARK, P. O. BOX 201, NEWARK, N. J.

All-Day Session to Be Held

The Newark Branch of the American Electroplaters' Society will hold an all-day educational session, which will be followed by the annual banquet, on Saturday, April 6, 1929, at the Elks' Club, Newark. There will be a few rooms for men available at the Elks' Club, and reservations can also be arranged at other hotels by communication with Horace H. Smith, 208 North Third Street, Newark.

This all-day session is expected to bring together an extraordinarily large body of electroplaters and chemists, due to the large number of special papers to be delivered, and also because at this session there will be held a Research Conference on Electroplating, under the joint auspices of the Branch and the Research Committee of the American Electroplaters' Society, with Oliver J. Sizelove presiding. This conference will take the place of one that would ordinarily be held at Washington, as in former years. It is believed that holding it at Newark will bring to it many more platers than if it were held in

Washington, because Newark is a more central point for the industry.

A tentative program for the Research Conference lists papers by the following: W. P. Barrows, Research Associate, American Electroplaters' Society; Dr. William Blum, Bureau of Standards; H. R. Moore, Bureau of Standards; H. L. Farber, Research Associate, American Electroplaters' Society; M. R. Thompson, Bureau of Standards; R. O. Hull, Research Associate, International Association of Electroplaters; C. T. Thomas, Bureau of Engraving and Printing; Philip Sievering, (report), Treasurer, Research Committee, American Electroplaters' Society. In a report on an investigation of the measurement of pH in nickel solutions, the following will participate: Dr. Blum; N. Bekkedahl, Bureau of Standards; K. Pitschner, American Chain Company; C. J. Rosecranz, Leeds and Northrup, Inc.; F. R. McCrumb, LaMotte Chemical Products Company; A. K. Graham, University of Pennsylvania; J. T. Burt-Gerrans, University of Toronto.

International Fellowship Club

HEADQUARTERS, CARE OF F. J. CLARK, 43 FORT PLEASANT AVENUE, SPRINGFIELD, MASS.

Annual Luncheon

The International Fellowship Club, representative organization of salesmen of plating and finishing equipment and supplies, held its annual luncheon at the Aldine Club, New York City, on February 16, when the New York Branch of the American Electroplaters' Society held its annual session and banquet. There was a large attendance, with Frank J. Clark presiding and Benjamin Popper, secretary, in charge of arrangements.

There were several addresses. R. A. Balzari, assistant general manager, McGraw-Hill Publishing Company, Inc., New York, spoke on "Selling." Dr. William Blum of the United States Bureau of Standards spoke on "Research in Sales." A. P. Munning, chairman of the Board of directors of Hanson-Van Winkle-Munning Company, Matawan, N. J., gave a talk on sales.

Business Reports in Brief

National Sanitary Company, Salem, Ohio, is planning the construction of several plant extensions.

Northern Bronze Corporation, has removed from 4212-20 Cresson Street to the southeast corner of Tenth and Tioga Streets, Philadelphia.

James Graham Company, Wooster Street, New Haven, Conn., brass forgings, has acquired additional land for expansion.

St. Thomas Metal Signs, Ltd., St. Thomas, Ont., Can., is having plans prepared by J. T. Finlay, 430 Talbot Street, for an addition to cost $30,000.

Springfield Aluminum Plate and Casting Company, Springfield, Ohio, is considering a one-story addition, to cost more than $4,000 including equipment.

Rogers Brothers Galvanizing Works, Rockford, Ill., will take bids for a one-story plant unit at Blue Island, Ill., to cost about $45,000 with equipment.

A. D. Joslin Company, Manistee, Mich., manufacturer of metal goods, is said to be planning a one-story addition to cost about $20,000 with equipment.

George L. Barnes of Everett, Wash., is erecting a building for a brass foundry. The new plant will employ about six men.

Northern Blower Company, W. Sixty-fifth Street and Barberton Avenue, Cleveland, Ohio, manufacturer of dust collecting equipment is enlarging its plant by an addition 75 x 125 ft.

Garrott Brass and Machine Company, Houston, Tex., moved to a new plant recently completed at Pease and Ennis Streets. John C. Garrott is president and owner.

Springer Bros. Company, Gadsden, Ala., manufacturer of plumbing equipment and supplies is planning an addition to its plant at East Gadsden to cost more than $115,000.

New Bedford Brass Foundry, 42 Front Street, New Bedford, Mass., has plans for a two-story addition, including improvements in present foundry, to cost more than $30,000 with equipment.

Barnes Metal Products Company, Chicago, Ill., has purchased property at corner of Sixteenth Street and Kilbourne Avenue, improved with a one-story building containing 50,000 sq. ft. of floor space.

Kittle Manufacturing Company, Los Angeles, Cal., manufacturer of metal stampings, automobile accessories, etc., has awarded contract for a one-story addition, 70 x 120 ft., to cost about $26,000 with equipment.

Freas-Therms Electric Company, 1208 South Grove Street, Irvington, N. J., manufacturer of electrical equipment, has awarded contract for a one-story addition, 90 x 160 ft., to cost over $50,000 with equipment.

James Neon Lights, Inc., Elm Street, Battle Creek, Mich., manufacturer of electric lighting equipment, is considering a two-story addition, to cost more than $35,000 with equipment.

The Watson-Stillman Company, 75 West Street, New York City, manufacturer of hydraulic machinery has appointed the Midvale Mining & Manufacturing Company, St. Louis, Mo., as its representative in that district.

Lamson & Sessions Company, Cleveland, Ohio, has placed contract for a four-story building, 83 x 185 ft., for heat treating and plating departments. It will be equipped for cadmium chromium, copper and brass plating.

Rome Company, 4th and Goodale Streets, Columbus, Ohio, manufacturer of metal bedsteads, etc., is planning to rebuild factory branch and distributing plant recently destroyed by fire. Headquarters are at Rome, N. Y.

Connecticut Jewel Manufacturing Company, Thomaston, Conn., manufacturer of ash trays, folding chairs and novelties has secured manufacturing quarters at Winsted, Conn. E. M. Grilley is president and general manager.

Porcelain Enamel Metal Products Corporation, Oxford, N. J., occupying a former building of Oxford Steel Company, will carry out expansion program including additional building and installation of three furnaces and other equipment.

Conshohocken Foundry Company, Conshohocken, Pa., recently organized by David Baker, Jr., Rosemont, Pa., and associates, with capital of $50,000, plans operation of local plant to manufacture iron, steel and other metal castings.

Fremont Aluminum Castings Company, Fremont, Ohio, has sold its plant and real estate to Charles J. Miller, president of the Fremont Foundry Company. The company will continue to operate the plant under the direction of E. J. O'Farrell, manager.

Canadian Hanson and Van Winkle Company, Ltd., Toronto, Canada, manufacturer of foundry equipment, etc., will build an addition to cost $10,000.

Day Name Plates, Ltd., Toronto, Canada, will have plans prepared for a factory to cost $35,000. Construction work will not start until spring or summer.

Houghton Manufacturing Company, Worcester, Mass., manufacturer of brass ferrules, etc., was partially destroyed by fire recently. The company plans to rebuild.

Liberty Starter Company, West Fort and Minnie Streets, Detroit, Mich., manufacturer of automobile starting and lighting equipment, for a four-story addition, 30 x 120 ft., to cost about $100,000 with equipment.

Hamilton-Beach Manufacturing Company, Racine, Wis., manufacturer of commercial and domestic utilities with fractional horsepower motors, is having plans prepared for a new foundry unit, largely for aluminum and alloy casting.

Dudlo Manufacturing Company, Fort Wayne, Ind., manufacturer of wire and cables, a division of the General Cable Company, N. Y., has awarded general contract for a one-story addition, 175 x 193 ft., to cost about $80,000 with equipment.

Star Machine & Novelty Company, Inc., Bloomfield, N. J., manufacturer of hardware specialties for radios and talking machines is completing a one-story plant on site 35 x 340 ft., at Hillside, near Newark, and will remove to the new location.

National Electric Products Corporation, Fulton Building, Pittsburgh, Pa., manufacturer of electrical equipment, has leased two story and basement building at Philadelphia, totalling 21,000 sq. ft., floor space, for a new factory branch and distributing plant.

Roy Manufacturing Company, Chicago, Ill., manufacturer of store and display fixtures, metal trays, etc., has leased a five-story and basement building at 220 W. Huron Street, and will remodel for a new plant. Additional machinery will be installed.

Rundle Manufacturing Company, Milwaukee, Wis., manufacturer of plumbing equipment and supplies, has plans for a branch plant at Camden, N. J., to cost about $1,000,000 with machinery. Bids will be asked on general contract early in February.

Machias Foundry and Machine Corporation, Machias, N. Y., will erect a new foundry and machine shop. The company will produce iron, brass, bronze, aluminum and alloy castings, having its own pattern and machine departments. Operation will begin in the early spring.

Art Metal Works, Inc., 7 Mulberry Street, Newark, N. J., manufacturer of metal automobile ornaments, toys, advertising novelties, etc., is disposing of stock issue to total $2,500,000, part of proceeds to be used for expansion. Plans are under way for a one and two-story addition.

Lockstrip Manufacturing Corporation, L. I. City, N. Y., has taken over the manufacture and sales of lockstrip department of Traitel Marble Company, L. I. City, maker of brass and other metal strips used in terrazzo, cement and composition floors. It also manufactures strip for insertion in cement finish of floors.

James Clark, Jr., Company, 520 W. Main Street, Louisville, Ky., manufacturer of electrical equipment, has been purchased by Lake States General Electric Company, Columbus, Ohio, and will become a division of the latter. W. S. Ball, formerly manager of James Clark, Jr. Company, will be manager of the new division.

Peerless Roll Leaf Company, 345 W. Fortieth Street, New York, manufacturer of metal leaf products, has acquired former factory of Reiss Premier Pipe Company, Union City, N. J., consisting of three-story and two-story units, 30 x 107 ft., and 107 x 146 ft., for a new plant. Present works will be removed to the new location and additional equipment provided for increased capacity.

Magnetic Manufacturing Company, Milwaukee, Wis., maker of high-duty magnetic separators, magnetic clutches and special magnetic equipment, has added trade name Stearns to its equipment in addition to former name High Duty. The designation is derived from the names of the officers, R. H. Stearns, president and treasurer, and R. N. Stearns, secretary. The company name remains unchanged.

Frank M. Windeman, vice-president and general manager of Fred Pabst Company, Milwaukee, Wis., manufacturer of steel and brass nipples and other specialties, has purchased business from Pabst Corporation, Milwaukee, and will continue it as **Frank Windeman Company,** a new Wisconsin corporation with a capitalization consisting of $150,000 preferred stock and 1,000 common shares without par value. It retains present shop in Pabst Industrial Community, 917 Juneau Avenue, Milwaukee.

Alchrome Bearing and Casting Company, Cheshire, Mass., has been acquired by Edward Runge, proprietor of Charles Runge and Son, Inc., of the same city. Mr. Runge is the son of Charles Runge, original proprietor of the Runge concern. Recently, the younger Runge bought all the capital stock of his father's company, a scrap metal business, and at the same time acquired the Alchrome company, together with the Protective Products Company, a new Cheshire firm which was organized recently in a portion of the Aeolian company's plant in Cheshire. The Alchrome company specializes in bronze, brass and aluminum products.

J. B. Klein Iron and Foundry Company, Oklahoma City, Okla., sends corrected information regarding expansion. Its engineers are now preparing plans for a steel fabricating plant, 100 x 350 ft., with storage yard. Later in the year the firm will build a reinforcing steel fabricating shop, 75 x 20 ft., ornamental iron shop, 100 x 200 ft., gray iron and non-ferrous foundry building, 70 x 100 ft., warehouse, 75 x 200 ft., and office building, 50 x 150 ft., two stories. The company will move from the present location at 1004 W. Second Street, to a new plant at Fourth and Blackwelder Streets as soon as the first unit of the new plant is completed. R. W. Robertson is president; C. A. Lord, engineer; Wm. Klein, superintendent; C. L. Bullock, assistant superintendent.

Monarch Aluminum Ware Company, Cleveland, Ohio, has acquired 100,000 sq. ft. of floor space in Power Warehousing Terminal Building, W. 94th Street and Detroit Avenue, and manufacturing facilities of Club Aluminum Utensils Company, now located at Baltimore and Chicago, will be consolidated in this plant. Monarch Aluminum Ware Company was organized in 1913 as a subsidiary to Monarch Brass Company. Recently the Club Aluminum Utensils Company acquired a half interest in this company. Club Aluminum Company will continue sales organization with headquarters at Chicago. The Monarch company in the new plant will specialize in the manufacture of permanent mold aluminum castings and will also operate a sand foundry. Polishing and assembly departments will be installed.

The Aluminum Company of America, Pittsburgh,

Pa., which is building a $2,000,000 alloy mill at Alcoa, Tenn., a report of which appeared in these columns some time ago, is planning to erect there a large division for the manufacture of metallic powders of aluminum, aluminum-bronze, etc. This mill, according to reports, will cost about $1,000,000 and will be started immediately. Its construction is in line with the large expansion in the use of aluminum paint. Work is in progress on four additional pot rooms at the old Alcoa plant.

Standard Aluminum Castings Company, Lansing, Mich., plans to resume full operations shortly, a part of the force having been recalled already, according to Louis Simon, manager. The company manufactures aluminum castings, largely for the automobile industry, holding large contracts with some of the major producers.

John Boone, who was associated with the Washington Metal Products Company, Washington Court House, Ohio, until about three years ago, will start operations shortly on the construction of a foundry in that city, to specialize in brass and aluminum castings. Mr. Boone is associated with other businessmen in the venture. The new works will be located at the B. and C. tracks and will be the first brass foundry in Washington Court House.

Chase Brass and Copper Company, Inc., Waterbury, Conn., has removed its Los Angeles, Cal., branch headquarters to 210 South Central Avenue, where it will have about three times as much space as in the former place on East Eighth Street. The new building is of brick; two story and basement. The local manager is L. B. Ard.

The Harshaw Chemical Company is the new firm style adopted by The Harshaw Fuller and Goodwin Company, manufacturers of chemicals, plating supplies, anodes, etc., of Cleveland and New York City. This company is headed by **W. A. Harshaw,** president. Change in name was made so that it would be more significant of the nature of the business.

New Companies

Nassau Brass Foundry, Brooklyn, N. Y., has been incorporated for $25,000 to $50,000.

Art Metal Guild, Passaic, N. J., has been incorporated for $100,000, to manufacture artistic iron, brass and bronze articles. The company's office will be at 666 Main Avenue.

Strand Enamel Company, Winsted, Conn., now being organized with capital of $100,000 has leased former plant of Franklin Moore Company, to manufacture wire drawing machinery, wire-enameling equipment, etc. It is understood that the company will be affiliated with Strand and Sweet Manufacturing Company.

Phoenix Brass Fittings Corporation, Irvington, N. J., has been organized to succeed Phoenix Brass Foundry, and expects to improve plant with economical installations during 1929 and to add to lines of brass products. No new buildings are contemplated.

United States Foundry Company, Los Angeles, Cal., has been organized by H. F. Long and has leased plant of Holbrook, Merrill and Stetson Foundry, to produce gray iron castings, specializing in stove and heater work. It will also make small castings, including aluminum. Sanitary ware will also be manufactured. The company is not at present in the market for equipment.

Trade Publications

Krometal Seals. Art Metalabel Corporation, York, Pa.

High Pressure Rotary Gas Pumps. The P. H. and F. M. Roots Company, Connersville, Ind. Engineering data in 16 page booklet.

General Electric Company, Schenectady, N. Y., publications: Some Outstanding Achievements of 1928; Type AW Resistor Arc Welders.

Easy Cutting Perfect Threads. Armstrong Manufacturing Company, Bridgeport, Conn. Concise tabulation of a wide variety of dies for use with Armstrong stocks.

Announcing the Ross "Senior." The Ross Manufacturing Company, Cleveland, Ohio. Pamphlet on a wheel truing which, according to the makers, has remarkably long bearing life.

How to Bronze-Weld Cylinder Blocks. The Linde Air Products Company, New York City. Useful information on an important phase of automobile repair and other similar work.

Perpetual Calendar. Taunton-New Bedford Copper Company, Taunton, Mass. A fine bronze frame holding a calendar made of celluloid, capable of serving indefinitely. It is an excellent example of the metal this company produces.

Enclosed Circuit Breakers. Roller-Smith Company, New York City. Type EAF, free handle, is described with full engineering data. This type of circuit breaker is intended for protection of motors and feeder circuits against overload and failure of voltage.

Telephone Almanac. American Telephone and Telegraph Company, New York City. A perennial achievement, this almanac is concise but well filled with a great variety of information which is useful as well as interesting. The format is very fine, having the smack of old times while being in fact extremely modern.

"D-12" and "Conqueror" Engines: Their Use of Nickel Alloy Steel. The International Nickel Company, 67 Wall Street, New York City. A very instructive pamphlet giving complete details of the two Curtis airplane engines mentioned in the title, with particular reference to the use of nickel steels; and also nickel aluminum alloy, of which the pistons are made. Illustrated.

Alpro Educational Service. Alloys and Products, Inc., Oak Point Avenue, New York City. A fine loose-leaf binder with a large amount of data on various "Alpro" alloys, designed to aid the practical man in the plant, as well as the technician, in acquiring a wider knowledge of alloys. The bulletins will be issued periodically and may be had gratis upon request to the company. The first issues deal mainly with brass foundry practice. Future issues will cover other branches of foundry and metal work.

Metal Prices, February 21, 1929

NEW METALS

Copper: Lake, 18.125. Electrolytic, 18.00. Casting, 17.75.
Zinc: Prime Western, 6.35. Brass Special, 6.45.
Tin: Straits, 49.00. Pig. 99%, 48.10.
Lead: 6.85. **Aluminum,** 24.30. **Antimony,** 9.375.
Nickel: Ingot, 35. Shot, 36. Elec. 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $123. **Bismuth,** $1.70.
Cadmium, 95. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 55.875.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $66.50.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	13¼to14½
Brass Ingots, Red	16½to17½
Bronze Ingots	17 to20
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	24 to40
Manganese Bronze Ingots	15 to18
Manganese Bronze Forgings	32 to42
Manganese Copper, 30%	27 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	17½to19
Phosphor Copper, guaranteed 15%	22½to25
Phosphor Copper, guaranteed 10%	21½to24
Phosphor Tin, no guarantee	60 to70
Silicon Copper, 10%.....according to quantity.....	28 to32

OLD METALS

Buying Prices		Selling Prices
15½to16	Heavy Cut Copper	16½to17
15 to15¼	Copper Wire, mixed	16 to16¼
12¾to13	Light Copper	13¾to14
10¾to12	Heavy Machine Composition	11¾to13
8¾to 9	Heavy Brass	9¾to10
7¼to 7½	Light Brass	8¼to 8½
10¼to10½	No. 1 Yellow Brass Turnings	11¼to11½
10¾to11	No. 1 Composition Turnings	11¾to12
5½to 5¾	Heavy Lead	6¾to 7
3½to 3¾	Zinc Scrap	4¾to 5¼
8 to10	Scrap Aluminum Turnings	12½to14¼
13 to13½	Scrap Aluminum, cast alloyed	17½to18½
19 to20	Scrap Aluminum sheet (new)	22 to22½
30½to32	No. 1 Pewter	35 to38
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled) .....27⅜ to 28⅜c. net base
From Stock .....28⅜ to 29⅜c. net base

BARE COPPER WIRE

19¾c. to 19⅞c. net base, in carload lots.

COPPER SEAMLESS TUBING

28⅜c. to 29⅜c. net base.

SOLDERING COPPERS

300 lbs. and over in one order .....25⅞c. net base
100 lbs. to 200 lbs. in one order .....26⅜c. net base

ZINC SHEET

Duty sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.75 net base
Casks, jobbers' price	10.25 net base
Open Casks, jobbers' price	10.75 to 11.00 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base, ton lots, per lb. 33.30
Aluminum coils, 24 ga., base, price 31.00

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 56¾ to 58¾ per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect Feb. 8, 1929
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.22½	$0.24	$0.26
Wire	.23	.24½	.26½
Rod	.20¼	.24¾	.26¾
Brazed tubing	.30½	....	.35¾
Open seam tubing	.30½	....	.34
Angles and channels	.30½	....	.34

BRASS SEAMLESS TUBING

27⅜c. to 28⅜c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	24½c. net base
Muntz or Yellow Metal Sheating (14"x48")	22½c. net base
Muntz or Yellow Rectangular sheet other Sheathing	23½c. net base
Muntz or Yellow Metal Rod	20½c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	28¾c.	10% Quality	31¾c.
15% Quality	30¼c.	15% Quality	35½c.
18% Quality	31½c.	18% Quality	38¾c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin. price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, February 21, 1929

ANODES

Copper: Cast	26½c. per lb.	**Nickel:** 90-92%	45c. per lb.
Rolled oval	26 c. per lb.	95-97%	47c. per lb.
Rolled sheets, trimmed	26¼c. per lb.	99%	49c. per lb.
Brass: Cast	25½c. per lb.		
Zinc: Cast	12¼c. per lb.		

Silver: Rolled silver anodes .999 fine are quoted from 58⅝ to 60⅝c., Troy ounce, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$29.65
14" 20 ply 64/68 Unbleached	38.20
12" 20 ply 80/92 Unbleached	31.85
14" 20 ply 80/92 Unbleached	43.20
12" 20 ply 84/92 Unbleached	42.50
14" 20 ply 84/92 Unbleached	57.60
12" 20 ply 80/84 Unbleached	38.35
14" 20 ply 80/84 Unbleached	52.00
Sewed Pieced Buffs, per lb., bleached	45c to 70c

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.14-.19
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic 100 and 400 lb. drums	lb.	.20½-.21
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30% bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.17¼-.21¾
Denatured, drums	gal.	.48-.56
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	3.3
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls.	lb.	3.3
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide. Drums	lb.	.06
Chrome Green, bbls.	lb.	.28
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.16½-.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	.06¼
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.29
Chloride, bbls.	lb.	.18
Salts, single, 300 lb. bbls.	lb.	.13
Salts, double, 425 lb. bbls.	lb.	.13
Paraffin	lb.	.05-.06
Phosphorus——Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.46½
Cyanide (fluctuating)	oz.	.57-.60
Nitrate, 100 ounce lots	oz.	.40
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.18
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone). bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.38
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¾